THURSDAY, MARCH 16, 1871

NATURAL HISTORY MUSEUMS

THE notes upon Natural History Societies which have already appeared in these columns * would be very incomplete unless some reference were made in connection with them to the subject of local Museums. We would by no means have it inferred that a Museum should be looked upon as an essential adjunct to every local society; nor would we urge upon any such body the formation of a Museum, unless the society was in a position to warrant the supposition that, if once started, there would be every probability that it would be kept up; but, at the same time it must be admitted that a well-arranged collection of objects in connection with the more important of our Field-clubs, especially such as are far from London or some other centre, would be extremely useful.

But, to be of any service at all to working naturalists, a local Museum must be a very different sort of thing from the Museums with which those who have visited country towns are familiar. Of course, no reference is intended to such collections as those at Liverpool or Manchester; but to those smaller ones which might be made very useful, but are at present practically useless, of which that at Canterbury may be taken as a fair type. Here the jumble of curiosities and objects of natural history is (or was, when we visited it in 1867) sufficiently remarkable; and the want of arrangement yet more striking. Ancient pottery and various implements of savage warfare, pieces of the *Royal George*, and samples of the meaningless curiosities which are brought home by travellers to their friends and relations, and are often got rid of by the said friends and relations on the first opportunity—these are present in full force. There are also drawers of foreign insects, unnamed, and more or less damaged; some stuffed birds; a good many fossils, the labels of many of which are misplaced; a small collection of dried plants, rapidly succumbing to the ravages of insects; and various other objects. This is, as far as we can judge from experience, a fair example of a country Museum, certainly by no means the worst which we might have selected.

Such a state of things as this may be contrasted with the following description of what provincial Museums ought to be, which we extract from Dr. Hooker's Address to the British Association in 1868:—"Each should contain a connected series of specimens, illustrating the principal and some of the lesser divisions of the animal and vegetable kingdom, so disposed in well-lighted cases, that an inquiring observer might learn therefrom the principles upon which animals and plants are classified, the relations of their organs to one another, and to those of their allies, the functions of those organs, and other matters relating to their habits, uses, and place in the economy of Nature. Such an arrangement has not been carried out in any Museum known to me, though partially attained in that at Ipswich; it requires some space, many pictorial illustrations, magnified views of the smaller organs and their structure, and copious legible descriptive labels, and it should not contain a single specimen more than is wanted. The other requirements of a provincial museum are, complete collections of the plants and animals of the province, which should be kept entirely apart from the instructional series, and from everything else."

One of the most hopeful experiments in connection with the establishment of a local Museum, is that which has just been set on foot at Folkestone by the Natural History Society of that place. There has for several years been a Museum at Folkestone, although visitors to the town may not have been aware of it; the management, or mismanagement, of it was vested in a committee annually elected from the town council for that purpose; and until lately admission could only be obtained by an order from one of these functionaries. The Museum, when we visited it in 1867, contained a very valuable collection of fossils, chiefly local, including a fine set from the unique Junction Bed of Folkestone; a few birds and fishes, and one or two other objects, the whole thickly covered with dust, and in a disgraceful state of neglect. In 1868 the Committee of the Natural History Society offered to take charge of it, on condition that they might have the use of the room for meetings, &c., and this offer was accepted by the Town Council, subject to the agreement of the Committee to provide glass cases for the objects at their own expense. This they very properly refused to do, and matters remained thus until the election of a fresh Council, when the Society again applied. The Museum was ultimately placed in the charge of the Society, the Town Council providing fittings to the amount of fifty pounds, and an annual payment of ten pounds towards expenses. The objects were at once arranged and named, and the Museum was formally reopened on the 4th of last October. It is now opened to the public twice a week, the secretary, Mr. Ullyett, to whose exertions the improved state of affairs is mainly owing, being in attendance to give information if required. The meetings of the Society are held in the Museum. The aim of the Society is to make a complete local collection, as well as a type collection, on the plan suggested by Dr. Hooker as above quoted; and to this contributions are solicited. A library for reference is also in course of formation.

We have entered thus into detail because the history of the Folkestone Museum is by no means uninstructive, showing as it does how readily such local collections are allowed to become utterly useless; and how, in restoring such Museums to the use of the public, a local society is doing a good work which only such a body could perform the remonstrances of mere individuals being powerless in such matters. We should be glad if other Field-clubs having a Museum within the radius of their operations, would exert themselves in the same way; the East Kent Natural History Society, for example, might well reorganise the Canterbury Museum; and examples might easily be multiplied.

A Museum may be looked upon as especially useful in a school society; and we have already referred* to that existing at Marlborough as presenting very satisfactory features. Mr. Preston, who has worked so hard on behalf of this society, is anxious to establish a typical collection in addition to the British one, which has already attained considerable proportions. The series of botanical diagrams lately prepared for the Science and Art Depart-

* See NATURE, vol. ii p 469, vol. iii. p. 161.

* NATURE, vol. ii. p. 249.

ment at South Kensington, under the superintendence of Professor Oliver, will be valuable for such collections, so far as botany is concerned. The Museum at Clifton College, built by Mr. Perceval at a cost of 900*l.*, will, we understand, be confined to British objects, and will be a combination of Museum and Library.

In conclusion, it cannot be too strongly insisted that objects of *vertu* or of curiosity should be rigidly excluded from any Museum, be it large or small, which is ostensibly set apart for the illustration of Natural History. It may require a certain amount of firmness to draw the line, and so run the risk of offending good-natured persons by the rejection of their proffered help; but it is best to take at once a definite position, and, unless the space at command be much larger than is usual in local Museums, to refuse even objects of Natural Science which do not illustrate some typical peculiarity, or at the least tend to the completion of a provincial collection. It is better to have a few objects, well arranged, and each teaching some definite truth, than hundreds of disconnected specimens, which, however interesting in themselves, are valueless as aids to instruction.

SCIENCE IN VIENNA

IT is well to turn from time to time to what is doing in the cultivation of Science in other lands. We are able to give the following details of the progress of Science, or rather of the machinery for the cultivation of Science, in Vienna, from a letter addressed by Prof. Haidinger to Dr. E. Döll, the editor of the *Realschule*, in the December number of which periodical the letter appeared. It was written by Prof. Haidinger in commemoration of the establishment, on the 8th November, 1845, of the first Viennese association for the cultivation of pure science, the twenty-fifth anniversary of which the writer thought deserving of celebration even in the midst of the exciting events of the disastrous war then waging between two of the most advanced of European nations; events the results of which, as he justly remarks, do not constitute the highest objects of human life, but on the contrary, evils, originating only from our still imperfect civilisation.

Before the year 1845 it appears from this letter that the only scientific societies established in Vienna dealt solely with the applications of scientific knowledge. Thus the Imperial Agricultural Society was founded in 1807, with the warm interest of the late Archduke John. Its progress was interrupted by the war of 1809, and its statutes were not confirmed until 1812. In 1836 the Imperial Medical Society was founded, followed in 1837 by the Imperial Horticultural Society, and in 1839 by the Industrial Association of Lower Austria. Gatherings of German naturalists and medical men took place at Vienna in 1831, at Prague in 1837, and at Gratz in 1843.

In 1835 a step of the greatest importance was taken in the establishment of the Imperial Mineralogical Collection, which took the name of the Imperial Montanistic Museum in 1843. The instruction given at this institution was supplemented by the forms of a society.

In the year 1845, the period of the Industrial Exposition produced considerable excitement, and on the 8th of November in that year a number of young miners, medical men, and naturalists, met in the Museum, and established an association under the title of the "Friends of the Natural Sciences in Vienna." The list of those present at the first meeting includes the names of several men who have since risen to the highest reputation. Haidinger himself, then president of the Montanistic Museum, took the warmest interest in the success of the nascent society, and endeavoured to bring it into a perfect form, but, for some reason, without success. The meetings, however, were continued until the year 1850, and the subscriptions of the members enabled Prof. Haidinger to publish seven volumes of "Proceedings" in 8vo., and four volumes of "Memoirs" in 4to. The association was broken up after the foundation of the Imperial Geological Institute in 1849, and the library belonging to it was subsequently presented to that institution.

1846. The 30th of May is the date of the Imperial decree for the foundation of an Academy of Sciences in Vienna.

1847. On the 14th of May the statutes of the Imperial Academy of Sciences were promulgated, and the first forty members nominated. On the 29th of June the first functionaries of the Academy were nominated, and on the 2nd of December its first meeting took place.

1848. On the 2nd of February, the Imperial Academy of Sciences was solemnly opened by its curator, the Archduke John, and after this meeting the first part of the "Proceedings" was issued, forming the commencement of a long series of most important works in all branches of Science. The Academy of Sciences is not a society formed by the spontaneous action of its members, but rather an exclusive corporation founded by authority.

1848. On the 8th June, the Austrian Society of Engineers was founded, and is the first spontaneously-formed Society.

1849. The Imperial Geological Institute was established on the 15th November, under the Minister von Thinnfeld, on the foundation of the Montanistic Museum. This Institution partakes of the nature of a school of instruction, combined with that of a society.

1851. The 9th April witnessed the foundation of the first spontaneously-formed Natural History Society in Vienna, namely, the Zoologico-botanical Society, which owes its establishment to the exertions of Georg von Frauenfeld, who opened its first meeting on this day with an introductory address delivered in the hall of the museum of the Botanic Gardens. Frauenfeld was the first secretary of this society, a position which he still continues to hold.

1851. In this year also the Imperial Central Institute for Meteorology and Terrestrial Magnetism was founded under the direction of Karl Kreil, as a sequel to the labours of a Meteorological Committee of the Academy, appointed on the 18th January, 1849.

1853. The Antiquarian Society was formed under the presidency of Prince Aloys of Liechtenstein, on the 23rd March. On the 29th March, 1854, Dr. T. G. von Karajan was elected president. This is an independently-formed society.

1855. On the 1st December another independent society was established, namely, the Imperial Geographical Society, which held its first meeting on this day in the rooms of the Imperial Geological Institute. On this occasion the first president, Prof. Haidinger, delivered an address.

In the year 1856 much excitement was produced among the naturalists of Vienna by the meeting of German naturalists and physicians in that city, and a great impulse was given to Natural History studies by the voyage of circumnavigation performed in the years 1857-1859 by the frigate *Novara*, under the auspices of the Archduke Ferdinand Max, afterwards, to his misfortune, Emperor of Mexico. During this period also there was a movement in favour of publicity in the medical and philosophical faculties of the University, and some series of public lectures were delivered.

1860. On the 6th December the Society for the Diffusion of Physical Knowledge commenced its proceedings in the apartments of the Imperial Academy of Sciences. The first general meeting took place on the 13th May, 1861, in the hall of the Musical Society, when Prof. Eduard Suess delivered a foundation address. The proceedings and lectures may properly be carried back through the agency of Dr. J. Grailich and his associates to the year 1855, when they commenced in the meeting-room of the Imperial Geological Institute. This society has continued to give lectures on Natural Science in two places, in one of which the old forms of a society are retained, whilst in the other lectures find interested listeners.

1861. The Photographic Society, independently formed, held its first meeting under the presidency of Prof. A. Schrötter in the green saloon of the Imperial Academy of Sciences on the 22nd March. The first photographic Exhibition in Vienna was opened on the 17th May, 1864.

1862. The Austrian Alpine Club was established, its first constituent general meeting being held on the 19th November.

1864. The Lower-Austrian Society for "Landeskunde held its first constituent meeting on the 16th December.

1865. The Austrian Meteorological Society was founded on the 16th November, with an address from Dr. Karl Jelinek.

1866. The year of the war. Prof. Haidinger retired in consequence of ill health from the direction of the Imperial Geological Institute, and was succeeded by Franz von Hauer.

1869. A section of the German Alpine Association held its meeting in Vienna.

1870. The Chemico-physical Society established under the presidency of Prof. H. Hlasiwetz.

1870. The Anthropological Society founded on the 13th February. Its opening meeting was held in the Consistorial Hall of the University, when the president, Prof. Karl Rokitansky, delivered an address.

1870. The Numismatic Society established.

It is with a considerable pride that the venerable Prof. Haidinger describes the rapid advance that has been made in the scientific progress of his native city, and dwells upon the fact that the first impulse to this movement was given by the association of the "Friends of the Natural Sciences," in which he took so much interest. The cause of the failure to form a well-established society from such a promising commencement he finds in the unfavourable conditions of the time; and doubtless the spasmodic political movements which so closely followed the year 1845 may well have distracted the attention of German men of science. The nascent society seems, however, to have merged into the Imperial Geological Institute, which has already done so much good work, and Prof. Haidinger is probably in the right when he claims for the "Friends of the Natural Sciences" in their new capacity a vigorous influence in the establishment of other scientific societies both in and out of Vienna.

The 8th November, 1845, may therefore well be "a day of joyful commemoration" with Austrian scientific men, for although, as Prof. Haidinger remarks, any retrospect reaching so far back must bring with it serious thoughts of the many participators in the first labours of the period who have disappeared from the scene, there is yet a higher point of view of a satisfactory nature, namely, that this period of twenty-five years has raised Austria to a far higher scientific position among nations than could have been claimed for her before, and, as he says, "Peaceful progress is certainly the highest and worthiest object of human endeavours."

LAUGHTON'S PHYSICAL GEOGRAPHY

Physical Geography in its Relation to the Prevailing Winds and Currents. By John Knox Laughton, M.A., F.R.G.S., &c. (London: J. D. Potter, 1870.)

THIS work is designed to show that the whole atmosphere, relatively to the surface of the earth, continually moves or tends to move from west to east, and that the permanent local variations from this direction are either eddies or deflections, formed in accordance with the principles which regulate the motion of fluids (p. 312). In the course of the discussion, Mr. Laughton has done good service by showing that prevailing opinions respecting the circulation of the atmosphere are very far from being in accordance with many well-ascertained facts; and by insisting on the dependence of oceanic on atmospheric currents, which is confirmed in every case where the facts are tolerably well known. The book also contains the best popular account we have of the prevailing winds over large portions of the ocean. But he is not so happy with respect to prevailing winds over the land, and in the reasoning he employs in proof of a general motion of the atmosphere from west to east.

It is stated that from Japan northwards the prevailing winds in summer are westerly (p. 136); and to the influence of these winds, blowing across the northern opening of the narrow seas of this part of the earth, are ascribed the southerly winds on the coast of China, and thence southward to the equator (p. 280). Now the prevailing winds of this region are not westerly in summer, the direction being E.S.E. at Tong-chow, S.S.E. at Pekin and New-Chwang, S.S.W. at Nangasaki, S.E. by S. at Chacodate, E. at Nicolajewsk near the mouth of the Amoor, and N.E. at Ajansk, S.W. also prevailing to some extent at the last place.

We are told that the wind blows almost constantly from the west on the north-west coasts of the Old and New Worlds respectively (p. 154). Now, whilst in winter the prevailing wind in Vancouver Island is S.W., at Sitka it is E.S.E., easterly winds being to westerly as 4 to 1, and E.N.E. at Ikogmut. Again, over the whole of the west of Norway, the prevailing winds in winter are either S. or S.S.E. or S.E.; at Christiania they are N.E., easterly

winds being to westerly as 8 to 3—a relation which could not hold if prevailing winds in this region were westerly. At Copenhagen the direction is S.S.W. In accordance with these facts the rainfall of the west of Scotland is much greater than that of the west of Norway.

Mr. Laughton maintains that there is, throughout the sea, no trace whatever of the air being drawn in to any place of greatest heat, &c. (p. 303), and adduces many instances in support of this opinion; but, curiously enough, every case adduced confirms the opposite view. This arises from a misapprehension of the principle involved in Buys Ballot's Law of the Winds, which may be thus put: Winds flow in towards the space where pressure is weak, vorticosely, so that in the N. hemisphere, standing back to the wind, the weak pressure is to the left. To take one case as an illustration:—Because the winds at Aden and south of Arabia do not blow directly in upon the heated sands of that region, but blow from W.S.W., it is concluded that there is no trace whatever in this part of the sea of the heated air influencing the winds. Now, if it be the case that there is at this season a weakening of the pressure by an ascending current of heated air from the surface of Arabia, then, according to Buys Ballot's law, the direction of the wind ought to be what observation shows it is, viz. W.S.W., and the more powerful the ascending current, the stronger will be the W.S.W. winds on the surface.

Mr. Laughton regards it as established presumptively that a westerly upper current everywhere prevails (p. 97). This he has shown generally to be the case as respects upper currents of tropical regions and a portion of the United States, but not as respects other parts of the globe. The explanation of these upper currents is easy. If the pressure of the atmosphere, at a uniform height of say, 10,000 feet, were ascertained, the highest would be immediately over the belt of calms, and the lowest over those regions where the mean temperature of the whole stratum, 10,000 feet thick, happens to be the lowest; this result being a simple consequence of the increased tension of air by heat, and diminished tension by cold. Since the pressure at the height supposed will continually diminish on receding from the Equator on either hand, it follows from Buys Ballot's Law that the prevailing upper currents ought to be westerly within the tropics, or, stated more exactly, W. by S. north of the Equator, and W. by N. south of it. It is during the winter months that westerly upper currents prevail in the United States. Since during this season the mean temperature rapidly sinks in advancing northwards over America, atmospheric pressure will be much weaker over British America at a height of 10,000 feet than over the United States, and hence by Buys Ballot's Law the upper current of the United States ought to be westerly. It may be remarked that since westerly upper currents are flowing towards colder regions, condensation of their vapour into cloud must frequently take place, thus rendering them visible; whereas since easterly currents flow towards warmer regions, condensation will seldom take place, and hence they must frequently flow past unobserved.

The broad zone included between latitudes 30° N. and S. comprises half the superfices of the globe. Over by far the greater portion of this zone winds are easterly, there being no season when any approach to a preponderance of westerly winds is apparent. When to these are added the easterly winds in extra-tropical regions, already referred to, a predominance of easterly winds in the north of Siberia and in the east of Australia, in their respective summers, and in a large part of the Arctic regions at all seasons; and though not a predominance yet the frequent occurrence, of easterly winds in the S. hemisphere, south of latitude 50°, it is plain that if there can be a preponderance of westerly winds over the globe viewed as a whole, it cannot be very great. A. B.

THE SEWAGE QUESTION

The Practical Solution of the Great Sewage Question, by a Combination of the Irrigation and Precipitating Processes. By William Justyne. (John B. Day.)

IN this little book the author tries to show that the A B C process is the only one which promises any hope of success among the methods which have been proposed or adopted for purifying sewage and utilising its valuable manurial constituents. "Miscellaneous schemes," including the dry-earth system, Liernur's process, and all the precipitation plans, except the favoured one, are dismissed very summarily, and the irrigation system is made to look as unsuccessful and as dangerous as its opponents have ever represented it to be, while the immense weight of indubitable facts and evidence on the other side is entirely passed over.

Then the A B C process is minutely described, and the scientific public is asked to believe that sewage, which contains suspended and dissolved organic and inorganic matters, and the chief value of which consists in the large amount of dissolved nitrogen, especially in *the form of ammonia*, which it contains, can be so purified by precipitation with a mixture of alum, blood, clay, animal charcoal, and what not, as that the effluent water shall contain no putrescible matter, and that the *precipitate* shall contain the manurial constituents!

What we do know with regard to the A B C and all other precipitating processes is, that they none of them separate out anything like all the dissolved (few of them nearly all the suspended) organic matters, and that the ammonia is necessarily all lost in the effluent water; indeed, several of these processes have been known actually to increase the amount of ammonia in the effluent water, by decomposing some of the organic matters. The only precipitating process which had the merit of attempting to throw down the ammonia was the phosphate process, which has been tried and abandoned so many times in this and other countries; the reason of its failure was very simple: the ammonio-magnesian phosphate which it was expected would be found in the precipitate, requires an excess of ammonia in the solution to render it at all insoluble, so that if any of this salt were contained in the sediment it would merely show that the effluent water still contained an excess of ammonia.

We must comment especially upon two points in which a person seeking for information is likely to be misled as to matters of fact by consulting this book. On page 17 we observe a table of the average percentage composition of solid and fluid human excreta, from which one might easily be led to suppose that the solid is more valuable than the fluid (as it is *weight for weight*), but we nowhere

find the important fact added that since for every ounce of solid excreta we have about 10 ounces of liquid, the total liquid excreted in a given time is worth about seven times as much as the total solid: so that as far as utilisation is concerned, the question which has to be solved is, how to deal with the liquid and its valuable constituent urea, or rather carbonate of ammonia, for it is as such that we find it in sewage.

The other point is the statement at the bottom of page 56, that "the analysis of the effluent water, after the sewage has been treated by the A B C process, is an analysis of the effluent water *solely;* whereas in almost every case where analyses have been made of the effluent water after the irrigation process, the effluent water has been diluted by at least double and sometimes three and four times its bulk, with perfectly pure spring and subsoil water." But then, how is it that the effluent water is, except during very wet weather, so very much less in quantity than the sewage sent on to the land? Mr. Justyne does not tell us this—we will tell him; it is because three-fourths, sometimes four-fifths, sometimes much more of the water has disappeared by evaporation from the leaves of the growing plants, and to a certain extent from the surface of the ground itself, so that to compare fairly the composition of the effluent water of the A B C process with that of an irrigated field, we must dilute the latter with distilled water until its bulk is equal to that of the sewage sent on to the land; even without this correction, the purity of the effluent water from irrigated lands has never been approached by any other method; with this correction, we think we may safely say that it is never likely to be approached.

Our author suggests that irrigation with the effluent water should be practised, when necessary, as a secondary and subordinate operation to the precipitation process; we submit that it has never yet been shown that it would not always be necessary to irrigate with this effluent water, both from a sanitary and an economical point of view, and it is plain that if to purify sewage, irrigation must be resorted to, any preliminary process which separates more than the offensive suspended matters, must be disadvantageous, by lessening the value of the liquid sent on to the land.

That the suspended matters should be to a great extent separated before the sewage is sent on to the land, we hold to be indisputable, but this should be done by some simple method, which leaves the sewage as *rich as possible* in dissolved manurial constituents.

In conclusion, from a chemical point of view, we object to reliance being placed on any precipitation process for the removal of its valuable constituents from sewage, and from a sanitary point of view we object to the effluent water from precipitation tanks being sent at pleasure into streams whose water is afterwards used for domestic purposes.

W. H. C.

OUR BOOK SHELF

The Honey Bee; its Natural History, Physiology, and Management. By Edward Bevan, M.D. Revised, Enlarged, and Illustrated by William Augustus Munn, F.R.H.S., &c. (Van Voorst, 1870.)

In this new edition of Dr. Bevan's well known work, Major Munn has given a full account of all the improved hives and methods of management, and of the most recent discoveries in the economy and physiology of bees. The old and the new matter are, however, so interwoven, that it is impossible for the reader to separate them; and as the original author and his editor both speak in the first person, we find ourselves continually at a loss to know whether we are reading "Bevan" or "Munn," except in those cases where some reference to dates enables us to decide.

An interesting experiment is detailed, proving that the business of a hive may go on a long time with perfect regularity without the presence of a queen. On the 13th June a swarm was put into a mirror hive. On July 1st, whilst the queen was laying drone eggs, she was taken away, yet the bees showed no agitation, but continued their work as usual. They formed several royal cells, and examined them continually to see if eggs had been deposited in them. All through the summer work went on as usual, honey being plentifully stored; but no attempt was made to raise a queen by artificial food, nor were the drones massacred. By the middle of November all the drones had died, and the working bees then began to diminish, and by December 31st they had also died. As all the workers had been born before July 25th, this gives about six months, or not much less, for the duration of their lives.

The fortifications and barricades of the bees against the incursions of the Death's Head Moth are said to be due to reason rather than to instinct, because it has been observed that they do not commence these fortifications on a first attack of the Sphinx, nor until they have been robbed of nearly their whole stock of honey. "This is a case in which the insect is taught by experience, and which admits, in all its particulars, of a direct comparison with human reason and contrivance. A colony that had been thus attacked one year, and was tardy in its defensive operations, having derived instruction from the past, constructed fresh ramparts speedily on the reappearance of the Sphinx three years afterwards, and thus guarded itself from an impending danger. Since the lives of the working bees do not extend beyond six or seven months, it is evident that the information of the colony above referred to must have been traditional, or else derived from a queen which had reigned over them three years previously." This "tradition" through some six or seven generations seems highly improbable, and that the knowledge of how to act was derived from a queen not less so. Do not the facts rather indicate that bees differ considerably in intellectual capacity, and that some hives contain directing bees more capable of acting promptly on the defensive than others?

Much information is given on the different kinds of foreign bees, and their peculiar modes of building. The importance of bees in fertilising flowers, and the use of nectar and of the colours of flowers as attractions, are fully recognised; but the recent discoveries of Darwin on this subject are not alluded to. So, in the discussion on the hexagonal form of the cell, the "circular" theory is opposed, and Mr. F. Smith is quoted against it; but the beautiful experiments of Mr. Darwin, as described in the "Origin of Species," with the satisfactory theory founded upon them, appear to be unknown to the author. "Darwin," it is true, is very frequently quoted, but it is always Doctor, not Charles, Darwin.

The book is illustrated by woodcuts of the various kinds of hives, and of the apparatus used by Apiarians. There are also some very scratchy but characteristic etchings of the different kinds of bees and of their anatomy, and several coarse coloured lithographs of varieties of comb, royal cells, &c., all executed by Major Munn himself. Though with some deficiencies of style and arrangement, the work abounds with information useful to the bee-keeper, and interesting to the naturalist.

ALFRED R. WALLACE

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

Eozoön Canadense

I CANNOT understand Mr. T. Mellard Reade's right to fling the taunt at those who maintain the foraminiferal nature of Eozoön, that "each disputant takes up a different position, and shifts it as occasion requires."

I have never taken up any other position than this: that *the best-preserved specimens of the Canadian Eozoön exhibit an unquestionably foraminiferal structure.* I am supported in this by every British naturalist with whom I am acquainted, as specially conversant with foraminiferal organisation, viz., by Messrs. H. B. Brady, T. Rupert Jones, W. K. Parker, and Prof. W. C. Williamson; whilst the most eminent authorities in micro-mineralogy and pseudomorphic structure, viz., Messrs. David Forbes, T. Sterry Hunt, and H. Sorby, altogether disown Eozoön as a mineral.

I have further asserted, and I do not in the least "shift" my position, that *the character of the Canadian Eozoön is altogether independent of that of later ophites.* The occurrence of true Eozoic structure in the newest Tertiaries would only show that Eozoön, like Lingula, has maintained its continuity through a long succession of geological epochs. On the other hand, the occurrence of minerals presenting superficial resemblances to true Eozoönal structure, can be of no account to such as really understand the latter.

If the Skye ophite, for example, possesses a true "nummuline layer" in combination with other characteristic Eozoönal features, its presence in a formation of later "geological time than the Laurentian," furnishes no argument whatever against its organic character.

If, on the other hand, the supposed "nummuline layer" in the Skye ophite is nothing but a lamella of chrysotile, the existence of such a pseudomorph can only affect the opinions of such as are incompetent to distinguish the two by those microscopic tests on which experienced observers feel perfect reliance.

Since I do not feel called upon to expend valuable time in giving to Mr. T. Mellard Reade the instruction which he requires to qualify him for discussing this question, I now leave him to the enjoyment of his own opinion. Whenever he shall have shown, by work of his own, his competence to criticise the observations of others who have made a special study of the subject he discussed, I shall be most happy to afford him the same opportunity of forming his judgment as to the organic nature of Eozoön, by an examination of my preparations, that I have given to the many eminent naturalists, who have thus fully satisfied themselves of the justice of my conclusions.

W. B. CARPENTER

Dr. John Hopkinson on "The Overthrow of the Science of Electro-Dynamics"

As I see you have reprinted at length Dr. Hopkinson's paper with the above title, in which he criticises severely, not to say ungenerously, some papers of mine published in the *Quarterly Journal of Science* and *Chemical News*, you will think it only fair to publish my reply, in which I think I shall show that, in the course of his short paper, Dr. Hopkinson has committed mistakes at least as grave and important as any he imputes to me. Let us see if this is not the case.

Dr. Hopkinson quotes one of my articles as follows: "They (that is Joule and Scoresby) calculate the maximum theoretical power of a grain of zinc to be 158 foot-pounds, and yet using permanent magnets, which, by their own statement, were so badly constructed as to have only a quarter the power they ought to have had, with the poles of the electromagnets never approaching the permanent magnets nearer than ¼ of an inch (and what an enormous loss is incurred here!); with an engine constructed almost at haphazard, and with scarcely a consideration of the best principles or of the most advantageous construction of such engines, they actually obtained a result of 102·9 foot-pounds out of a calculated theoretical maximum of 158. With a little care and consideration, I do not hesitate to say the duty per grain of zinc might easily have been increased tenfold." On which he observes, "It is hardly credible, but the above looks very like a confusion between Force and Work! The author seems to assume that if the forces in operation in an engine are greater, that the engine will necessarily produce more work from the same quantity of fuel. In these experiments the quantity of zinc $(a-b)$ used to produce work W is observed; if the engine was made more powerful, if the permanent magnets were four times as strong, and the electromagnets passed ¼ of an inch from them, doubtless W would be greater, but so also would $(a-b)$, and it does not follow that $\frac{W}{(a-b)}$, with which we are concerned, would be at all changed. What becomes, then, of the dogmatic assertion that the duty of a grain of zinc would be increased tenfold?"

Why he should say, "It is hardly credible, but the above looks very like a confusion between Force and Work," I know not. I cannot plead guilty to having made the slightest confusion between the two. I do think the total of the force used is *a measure* of the work produced. But Dr. Hopkinson tries to persuade us that a well-constructed engine would do no more duty than an ill-constructed one, and consequently, I presume, that the magnets might possibly be weakened *ad infinitum*, and removed to ever so great a distance, without necessarily affecting the efficiency of the engine. And then he ventures to criticise my papers as full of fallacies! I retort that it is hardly credible, but that the above looks very like a confusion between $(a-b)$ and b! In these experiments of Joule and Scoresby's the quantity of zinc used to produce work W, is represented by the authors not as $(a-b)$ but as b, and therefore the duty per grain of zinc is not $\frac{W}{a-b}$ but $\frac{W}{b}$; and when the permanent magnets are stronger, and the electromagnets are passed nearer to them, not only does W increase but b also diminishes. So that was I not justified in saying that the duty of a grain of zinc could in a better-constructed engine be probably increased tenfold? And if it be increased only twofold, or even half as much again, then, allowing for waste, I have proved my point, and disproved Joule's mechanical equivalent of heat. Might I not retort fairly on Dr. Hopkinson that the Manchester Literary and Philosophical Society "never ought to have permitted this paper to appear in their Proceedings?"

Next let us take Dr. Hopkinson's next criticism. My argument is this:—That if the doctrine of the mechanical equivalence of heat be, *that production of energy absorbs, and destruction of energy produces, a definite amount of heat*, and if we find cases, as those of elastic wires, and water below its maximum density, in which destruction of energy produces cold, not heat, the doctrine of the mechanical equivalent of heat cannot be universally true. To this argument Dr. Hopkinson replies that the facts I quote as paradoxes are simple deductions from the two laws of thermo-dynamics. Quite true; but this only shows that one of the laws of thermo-dynamics is inconsistent with the doctrine of the mechanical equivalence of heat. Might I not retort again on Dr. Hopkinson that "a hostile critic should at least understand the meaning of what he criticises"?

If I said anything which *seemed* to imply that a minimum of work in an engine was inconsistent with a maximum of duty, I freely retract the expression; and I also acknowledge that the argument drawn from the fire-syringe had better have been omitted. But my point was proved abundantly without it.

But still, as the maximum of work done by a battery before it is worn out is only a multiple of the maximum duty of a grain of zinc, I do think it is a *startling* thing, though not mathematically impossible, that this maximum of work should prove to be no work at all.

Perhaps you will allow me to add that I have read Sir W. Thomson's paper read before the British Association in 1852, to which your own reviewer referred me. No doubt you will think it presumptuous in me to say so, but I think that in that paper he has mixed up two totally distinct questions, namely, the cold produced by the decomposition of water into its elements at two electrodes, and the heat produced by the resistance of the film of hydrogen or oxygen or oxide, to the passage of the current. The first is a fixed determinate quantity; the second an accidental one depending on the character of the surface of the electrode, and the ease with which it throws off the film of hydrogen or oxygen. These two points affect the question, as well as the polarisation, and the specific power of retaining or transmitting heat exercised by various electro-motive combinations. M. Favre suggests the formation, sometimes, of peroxide of hydrogen; but this supposition is unnecessary, and, moreover, would not remove the difficulty, for peroxide of hydrogen is so unstable a compound, that it would soon be resolved into oxygen

and water, and thus exactly undo the thermal effect of its formation. I trust that in this letter, at least, you will find nothing unfit to be published in a scientific journal.

H. HIGHTON

P.S. I hope to discuss the question *vivâ voce* at the meeting of the Manchester Literary and Philosophical Society next week.

MR. HIGHTON has very effectively shown the uselessness (to him) of my review of his speculations. I wish I could withdraw it, and allow his letter to speak for him without any comments of mine. When a man can make the remarks he has made on Sir W. Thomson's paper of 1854, his case is hopeless—he is incapable of being taught even by the "grand founders" of the science. *Requiescat.* YOUR REVIEWER

Quinary Music

HAVING hitherto been under the impression that all the varieties of time in music might be regarded as made up of groups of two or three, and never having seen a single piece of music which in any way contradicted this view, Mr. J. Mullen's letter on "Quinary Music" in NATURE for the 9th inst. surprised me very much indeed. It is true that sometimes we meet with passages in which five notes are to be played in the time of four, or seven in six, &c.; but a piece of music in five time is a thing I at least have yet to see, and I should feel obliged to Mr. Mullen it he will kindly tell me the name and composer's name of this novelty. BEACON LOUGH

The Experimental and Natural Sciences in Trinity College, Dublin

I TRUST you will allow me to make a few remarks upon the article signed "W." which appeared in your last week's number.

In the first place, there are one or two inaccuracies which may be corrected. Thus, your correspondent states that a student "in his third and fourth years *must* devote himself, to a certain extent, to the study of Experimental Physics, including heat, electricity, magnetism, and chemistry, and pass examinations on these subjects, even at the ordinary term examinations." The sophister students are indeed *allowed* by the Board to substitute such a course for classics, but, it may be added, comparatively very few avail themselves of this permission. Again, it is declared that "the chemical and physical laboratories leave nothing to be desired." No such thing as a "physical laboratory" exists in the University; and, seeing that it is only lately that such things have been introduced at the other side of the Channel, it is scarcely likely that we shall have one here for some years to come.

But what I think especially calls for criticism is the general tone of the article, leading the reader, as it appears to me, to suppose that the Experimental and Natural Sciences occupy a high status in Trinity College, Dublin. Now this is far from being the case; there can be no doubt that they are still generally looked upon in the University as subjects of quite secondary importance. A.

Dublin, March 14

Science in Schools

I SHOULD be greatly obliged if you would kindly let me know of any school adapted for young boys whose parents wish to give them an education embracing the physical sciences and modern languages, on some such plan as that of the Realschule of Germany. W.

Dr. Donkin's Natural History of the Diatomaceæ

THE remarks of "K." on my review of the above-named work (*vide* NATURE, vol. iii. p. 348) fall under five heads. Allow me to briefly notice each. 1. There is a difference of opinion between us as to the execution of the plates in Part I of Dr. Donkin's work; my copy came direct from the publishing office, it is therefore presumably a fair specimen. I have once more examined the plates, as well as shown them to several competent judges, and the unanimous verdict of all is that expressed in my notice, *i.e.* the execution of the plates in this part is disappointing. I gave instances of apparent inaccuracy in detail in some of the figures. "K." passes these by, but cites figures that are accurate; surely there is nothing contradictory in this. My criticism related for the most part to the *execution* of the plates, and I confess that even comparing them to those illustrating Dr. Donkin's or Mr. O'Meara's papers on Diatoms in some of the late volumes of the *Quart. Journ. Micr. Sci.*, I would prefer the lithographic plates to the engraved ones.

2. "K." agrees with me about the synonymy. I agree with him as to the difficulty of this portion of the subject, but what value would this or any work on species have without synonyms?

3. "K." says the desirability of giving habitats in full is questionable, "three or four localities are sufficient." Unquestionably it is not desirable to give more than three or four localities for common forms, but I think it is equally unquestionable that when Dr. Donkin could have given as many localities for interesting and not extremely common forms, he was wrong not to have done so; and I alluded to the absence of Irish localities in the hope of removing an evident defect in an otherwise useful work.

4. "K." is, without doubt, right in referring the species given by him to Gregory, and not to Ehrenberg. I cannot imagine how so great a blunder on my part originated.

5. "K." asks, "who is Cleeve?" Cleve (not Cleeve), next to Heiberg of Copenhagen, is one of the best northern investigators of the lower Algæ. His monograph of the Swedish species of the Zygnemaceæ is well known, and in addition to his papers on Desmideæ and Oedogonium, he has published "Diatomaceer fran Spetsbergen" (1867) and "Svenska och Norska Diatomaceer" (1868). He naturally follows the arrangement of the "Conspect. Crit. Diatom. Danicarum." It is not without interest to observe how well acquainted these botanists are with the literature in our language relating to the Diatomaceæ.

W.

Lenses for Vision Below Water

IN a communication on the Dioptrics of Vision which appeared in your impression of the 15th December last, I described a form of air-lens for vision beneath the water. Further experience has shown me that the measurements I then gave were not so accurate as they might have been. Thus, the radius of curvature of the glasses in the air-lens to form a lens with a 2 in. focus in water is not 1¼ in. as first stated, but 1 in. only.

Again, I somewhat underestimated the magnifying power of the anterior lens of our eye, formed by the aqueous humour, when I set it down as a lens with a focus of 2 inches. 1½ inch is more correct. In accordance with this, I find that for the most perfect vision under water, we require a glass lens of ⅝ in. focus in air (in place of 1 in. as formerly stated), or an air-lens formed with two segments of a hollow glass globe 1⅜ in. in diameter, placed concavities outwards. Both these lenses have in water a focus 1½ in. long.

These lenses are for fresh water. Sea water having a greater refractive power than fresh water, requires for perfect vision a somewhat *more convex* glass-lens and a somewhat *less concave* air-lens. I find that an air-lens made with segments of two glass globes of the diameter of 2 inches and 1⅜ inches respectively, when immersed in sea water forms a lens of 1½ in. focus. But I should observe that good vision under water is obtained by lenses of various magnifying powers, ranging from 1½ to 2 inches focus; but for the distinct vision of small text-type under water, the higher magnifying power is required, and it also is the best for distant vision under water.

53, Montagu Square R. E. DUDGEON

Petrography

THE few English geologists who take an interest in petrography will be thankful to Mr. Geikie for the communications from him which have appeared in NATURE. It is too true, as he observes, that our progress in this branch of geology has for many years been simply *nil*, but there are now manifest signs that this unsatisfactory state of things is drawing to a close. Some of our working geologists are quite aware of the necessity which exists for the application of the microscope to the examination of rocks, and they do not doubt that the result will be proportionately as great as it has been in other branches of inquiry.

It may in the first place be observed that the unsatisfactory nomenclature at present in use is due to the fact that a considerable proportion of the igneous rocks have been named without any precise knowledge of their mineralogical composition, mere chemical analysis being quite inadequate for the solution of the problem; and now there is an evident tendency

towards the partial adoption of a chronological classification, founded, no doubt, on the prevailing belief in an essential difference between the "plutonic" and "volcanic" rocks, and on the notion that the age of such rocks may be determined by their mineral constituents, just as sedimentary deposits may be recognised by their included fossils. The microscopical examination of many hundred thin sections of the older melaphyres and more recent basalts establishes the fact that no such essential difference exists, but that, on the contrary, the same minerals are the constituents of both; a difference there undoubtedly is, but the microscope shows that it has been produced by chemical action operating under more or less favourable circumstances during long periods of time. Numerous specimens of the so-called melaphyres from the coal-fields of Scotland and the midland counties are unquestionably composed of the same constituent minerals as the tertiary basalts from the coast of Antrim, Auvergne, and the Rhine.

On comparing the least altered portions of the older rocks with some of the basalts, no difference whatever is observable; triclinic felspar, magnetic oxide of iron, augite, and olivine are the chief ingredients of both. The latter mineral has been regarded as characteristic of the more recent basalts, but, as I have shown elsewhere,* it exists quite as frequently in the melaphyres.

The fact, however, on which it is most important to insist, and which has not hitherto been recognised, is that the difference now existing between old melaphyres and recent basalts is due to chemical action subsequently to the formation of the rocks; not only have most of the amygdaloids been thus formed, and numerous microscopic cavities filled up, but the felspar is frequently much altered, and pseudomorphs of olivine, augite, and hornblende have been formed; thus producing a marked change in the colour and hardness of the rock. Pseudomorphs of olivine are the most abundant, and are of great interest, as crystals in various stages of alteration may frequently be observed.

Prof. Zirkel has shown that in some basalts the various constituents have crystallised firmly together, and lie in actual contact with each other without any intervening cement, while in other cases there is an amorphous glassy substance in which they are embedded. Precisely the same facts may be observed in many melaphyres, and notably so in some of the rocks from the Glasgow coal-field. Many of these rocks from the Scottish carboniferous strata are of great importance in these investigations, as their age has been satisfactorily determined by the valuable labours of Mr. Geikie and his brother.

In revising the nomenclature, it will be for petrologists to decide whether or not two rocks originally of identical composition should receive different names because one has undergone a certain amount of alteration. In most cases there is undoubtedly a difference in their appearance, and it might be convenient to recognise the fact in the nomenclature; but Mr. Geikie's anticipation that "there is such an insensible gradation that no sharp line can be drawn between them" will certainly have to be recognised.

If this method of microscopical analysis is carefully carried out on a sufficiently extensive scale, there can hardly be a doubt that we shall soon acquire a more satisfactory knowledge of all the older rocks; some little has already been done with the melaphyres, and I hope shortly to submit the results to the judgment of those interested in the subject. S. ALLPORT

Tin

THE discussion of the isolation of St. Michael's Mount subject has now branched off into a subsidiary question, which should not pass unnoticed. A writer dwelling on the abundance of tin found in Britain, argues that this natural product of our soil has given a name to our island home. I have met with this suggestion elsewhere, but have never been able to accept it. Our word *tin* is of comparatively modern formation. The Welsh word is *ystaen*, which corresponds so closely with the Latin *stannum* as to lead to the inference that the one form is derived from the other, although we may not be able precisely to say which is the elder of the two.

Now, all things being equal, our modern word *tin* might be accepted as a corruption of either of the above forms; but that it really is more nearly allied to the Teutonic forms of the same word, as found in Saxon, Danish, German, Swedish, &c., all being equally traced to a primitive root preserved in the Sanscrit word *tan*.

* Geol. Mag. vol. vii. p. 159.

It will thus appear almost certain that our word *tin* is of Teutonic origin, and not used in this island so early as the argument for its forming a particle of the word Britain requires. My objection being thus stated, that the word *tin* is a comparatively modern word with us, if of Teutonic origin; yet, on the other hand, if it be assumed as a plausible corruption of the Welsh *ystaen*, or the Latin *stannum*, it appears to me that the primitive words for Britain ought to be found spelt in such variety of form as to lend some countenance to this idea, if it be really founded on fact. But it is not so; consequently we must not indulge the fancy that that useful metal "tin" has any place in the construction of the word Britain. A. H.

PAPERS ON IRON AND STEEL

NO. III.—THE BESSEMER PROCESS*—(*continued*)

RETURNING to the Bessemer flame, we now reach what I have described as its second stage, when its dimensions and brilliancy reach their maxima. We know that carbon must be burning there, and in no small quantity. The average of above three per cent. shown in the analyses, gives in a charge of six tons more than 3·6 cwt. of carbon, requiring for its complete combustion into carbonic acid nearly half a ton of oxygen, or about two tons of atmospheric air. There need be a mighty roar to pour forth all this, and the 14cwt. required for the silicon in the course of about twenty minutes. An interesting problem now presents itself in the whiteness and brilliancy of the flame. It is totally different from the carbonic oxide flame which is produced by the combustion of carbon *per se*. Whence comes this whiteness? Is it due to the combustion of iron in addition to that of carbon, to solid particles of carbon, or is there any important quantity of hydro-carbon present?† The latter explanation is forcibly suggested by the appearance of the flame, and is, I think, to some extent, confirmed by the spectroscope. There is still, however, some red smoke above the flame, which, though less abundant now than in some other stages of the blow, is sufficient to indicate that some iron is burning, probably small particles mechanically ejected into the flame by the force of the blast.

It is during this period of the blow that the lines which have been figured and described by Dr. Watts and Dr. Roscoe as the spectrum of the Bessemer flame are most distinctly displayed. This spectrum includes some of the iron lines, the lines of lithium,‡ sodium, and potassium, and the red band of hydrogen seen as a black band, besides the very complex series of lines which have been designated "the carbon lines" of the Bessemer flame. These lines probably include a hydro-carbon spectrum,—I say "probably," because they do not exactly correspond with the hydro-carbon spectra with which they have already been compared. Nitrogen lines are also displayed, but whether these are due to cyanogen, or to any other compound including carbon and nitrogen, has not yet been determined. What then is the particular compound of carbon which is burning in the Bessemer flame? Is it a hydro carbon, and if so, with which of the many known varieties of hydro-carbon does it correspond? Do the nitrogen lines belong to any compound of nitrogen whose spectrum may be identified?

These are questions of considerable philosophical and practical interest which, I think, the spectroscope may be made to answer. Hitherto, the spectroscopic investigations

* We regret that, owing to the pressure on our space, we have been compelled to keep this article, and the one printed last week, in type for some weeks; similar conclusions have in the meantime been arrived at by other observers.—ED.

† I speak of solid particles of carbon as quite a distinct case from hydro-carbon flame, believing in the soundness of Frankland's conclusion that the brilliancy of a hydro-carbon flame is *not* due to the combustion of solid particles of carbon. My own experiments on the transparency of the *white portion* of common coal gas flames strongly confirm Dr. Frankland's view.

‡ I have only found the lithium occasionally. In many instances I have watched a blow from beginning to end without observing any appearance of the red lithium band which, when seen at all, is so unmistakeably brilliant.

of the Bessemer flame, though skilfully and laboriously conducted, have been curiously barren of philosophical results, and for practical purposes altogether a failure. If the above questions were answered it would be different.

During the first part of the blow a large proportion of the graphitic carbon of the grey iron becomes converted into the condition of "combined carbon" such as exists

FIG. 1.—"BOMBS" PRODUCED IN THE BESSEMER PROCESS.

in steel and white cast-iron. What then is the condition of this carbon if it yields a cyanogen or hydro-carbon spectrum? Nitrogen has been found in considerable quantities in cast-iron which is rich in carbon. Steel makers know that organic compounds containing nitrogen as well as carbon are far more efficacious in cementation than carbon in a state of comparative purity. Thus, bone dust is more effectual for case-hardening than wood charcoal, and ferrocyanide of potassium still more effectual than bone dust. Every steel maker is the proud possessor of a profound secret, a "physic" which he furtively buys from a distant druggist or drysalter, and having disguised its yellow colour by grinding it with lamp black, locks the physic in a strong box and the secret in his own bosom. As this profound secret, like so many others, is perfectly well known to all whom it may concern, I perpetrate no breach of confidence in describing the "physic" as the ferrocyanide of potassium. Its value is unquestionable, but *how* it acts is still a mystery.

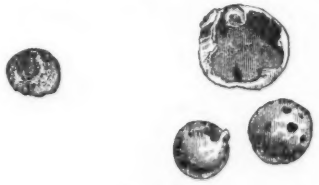


FIG. 2.

Some chemists have maintained that a nitride of iron is essential to the production of steel, and others have hinted at the existence of a cyanuret. As we know that carbon exists in the same condition in white iron as in steel, a question of considerable interest is offered for spectroscopic solution, viz., Is cyanogen burning in the Bessemer flame? Again, we have another set of workshop facts and laboratory experiments which go to show that for the production of steel, hydrogen in the form of hydro-carbon is necessary. It is well known that coal gas, paraffin, and other hydro-carbons, are more efficient cementing agents than pure carbon. Dr. Percy found that the charcoal of sugar, which retained some hydrogen or hydro-carbon, readily converted iron into steel, but that the same charcoal failed to produce steel under similar circumstances, after it had been deprived of its hydro-carbon. It is well known that wood charcoal which has been several times heated in the cementing furnace, loses some of its power of cementation, and this has been attributed to the driving off of the hydro-carbon contained in the fresh charcoal.

Again, it is found that when, by means of an acid, we dissolve the iron of steel or white iron away from its carbon, the residue is not simple solid carbon, but an unmistakeable liquid hydrocarbon, an oil which, like other hydrocarbons, burns with a smoky flame. In this case it is possible that the hydrogen may be supplied to the carbon by the water or the acid. If so it presents an interesting case of the formation of what we usually regard as organic matter from inorganic materials.

If, on the other hand, the hydrocarbon exists ready formed in the steel and the white iron, the conversion of grey iron into white iron, *i.e.* of graphite into this hydrocarbon, is a still more remarkable case of the same kind.

It is true that the hydrogen may be detected by a direct combustion analysis, but this does not reveal the mode of its existence. The information thus afforded is analogous to what we obtain by similar means respecting nitrogen.

The last change that occurs in the flame, that which announces to the foreman the time for stopping the blow, requires but little explanation; but it is, nevertheless, instructive if thoughtfully examined. The contraction of the flame and loss of brilliancy is evidently due to the exhaustion of the carbon. The change which occurs is very similar to that which is observed when air is admitted to a jet from which coal gas is burning.

If to such a jet, supplied with a constant quantity of coal gas, atmospheric air be admitted, so that it shall mix with the gas before burning, the white or luminous portion of the flame will contract in proportion to the quantity of air supplied, and if a gradually increasing quantity of air be admitted, this contraction will progress until the white flame is totally extinguished. Mr. Jonathan Wilkinson, of Grimesthorpe, who has been recently investigating this subject with a view to practical photometric applications, finds that the quantity of air required thus to extinguish the white flame is proportionate to the quantity of carbon combined with the hydrogen, or to the illuminating power of the gas,—that for every standard "candle" of illuminating power about 0·2 of air is required. Thus fifteen-candle gas will require three times its own volume of air at the same temperature and pressure for the extinction of the white flame, seventeen-candle gas 3·4 of air, and so on.

In the case of the Bessemer flame, we have a constant supply of air to a diminishing supply of carbon, and therefore we may expect that there should occur in the white portion of the flame due to hydro-carbon a change corresponding to that which would occur in Mr. Wilkinson's photometric flame, if, instead of a constant supply of coal gas mixed with an increasing supply of air, he maintained the air in constant flow and gradually closed the gas-cock. In this case there would not only occur a gradual diminution of the brilliancy but also of the dimensions of the flame.

Such is the change which takes place in the Bessemer flame towards the end of the blow, and it so far confirms the hypothesis that a *considerable portion* of the white flame is due to hydro-carbon. If it were due to the combustion of iron the white flame should increase towards the end of the blow, for it is then that the iron, when no longer protected by the more combustible carbon, begins to burn in a serious degree, just as I have shown that the full combustion of the carbon takes place after the bulk of the silicon has been oxidised.

FIG. 3.

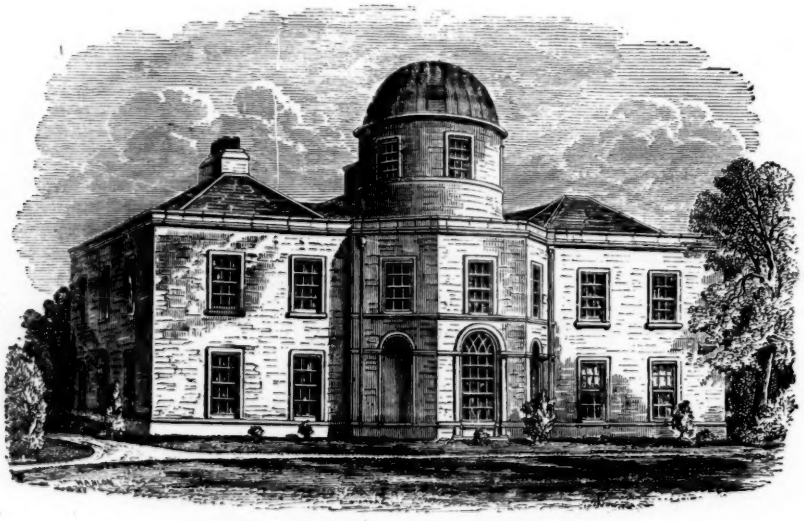
W. MATTIEU WILLIAMS

THE OBSERVATORY OF TRINITY COLLEGE, DUBLIN

IN 1774, Dr. F. Andrews, Provost of Trinity College, Dublin, died, having bequeathed to the College the sum of 3,000*l.* to build and furnish an Observatory, and a further annual sum of 250*l.* as payment of a Professor of Astronomy. Unfortunately, litigation arose, and it was not until about 1781 that it was settled. In 1783 Dr. H. Ussher was appointed Professor; in 1788 the present site of the Observatory was purchased and the buildings erected. Ramsden was commissioned to build the transit instrument, but innumerable delays occurred, and it was not set up until 1808, eighteen years after Professor Ussher's death, and during the professorship of Dr. Brinkley. In 1791 a License of Mortmain, together with a statute for regulating the duties of the Professor, were obtained, and the College expended out of their private funds several thousand pounds, so as to carry out the intentions of their late Provost. The competition for the professorship is open to all the astronomers of Europe. Since its foundation four have been appointed: Dr. Ussher, in 1783; Dr. J. Brinkley, of Cambridge, in 1790; Sir William Hamilton, in 1827; and Dr. Francis Brünnow, in 1865. The Professor of Astronomy is also Astronomer Royal for Ireland. Since 1831 the stipend granted to the Professor is 700*l.* per annum, which includes the pay of an assistant and gardener.

The Observatory is situated about five miles from the College, at Dunsink, to the north-west of Dublin, beyond the Phœnix Park. It lies amid extensive fields and pasture lands on the summit of a hill nearly three hundred feet, close to the sea level. The accompanying woodcut represents the principal front of the Observatory. By the Statute of 1791 it is enacted, among other things, that a fair copy of the observations made every year shall be presented to the College, and also that the observations shall be printed every year at the expense of the College, the Professor to supervise the press, and copies to be sent as presents to the principal observatories, academies, libraries, and eminently-learned persons both at home and abroad; the remaining copies to be sold, and the profit given to the Professor for his care and trouble in supervising the printing of the observations.

We welcome with great pleasure the first part of a series



THE OBSERVATORY OF TRINITY COLLEGE, DUBLIN

of "Astronomical Observations and Researches made at Dunsink" by the present Astronomer Royal for Ireland, which has been printed and circulated within the last few weeks by the College. It consists of a quarto part of eighty-eight pages, and it is accompanied by three plates. It embraces the results of observations made with the "south" refractor, from June 1868 to October 1869, and contains—1. Description of the "South" Refractor. 2. New determination of the Parallax of α Lyræ. 3. Determination of the Parallax of 61 σ Draconis. 4. Micrometrical measurements of double stars. 5. Observations of α Lyræ and companion; and 6, Observations on 61 σ Draconis. The plates represent the new dome erected for the "South" Refractor, a sketch of the wheels on which the dome revolves, and the interior of the dome and sketch of the "South" Refractor.

The object glass of this Refractor was given in 1863 to Trinity College, by Sir James South. It was given with a valuable collection of astronomical instruments on the accession of the Right Hon. the Earl of Rosse as Chancellor of the University. This glass is 11¾ inches diameter, and was purchased by Sir James South forty years ago from Cauchoix in Paris. The good qualities of the glass had already been fully appreciated by Arago, who recommended the French Government to purchase it for the Paris Observatory. Shortly after the appointment of Professor Brünnow, the Board made arrangements for procuring a mounting, and for erecting a suitable dome. The wall of the dome is of stone, neatly panelled on the inside with wood; the dome is of timber covered with copper; the diameter of the building is 27 feet. The machinery for moving the dome is very ingenious, and was designed and executed by Mr. Grubb. The dome can be started by applying a force of six pounds, while five pounds suffice to keep it in motion; its opening is 2½ feet wide, and extends from the horizon to a little beyond the zenith. The support, or the mounting, is solid pier-built on the limestone rock. The equatorial mounting was made by Mr. Grubb. The motion of the clock is very steady, keeping a star steadily on the wire. The Filar micrometer was made by Pistor and Martins, of Berlin.

The present series of observations show what work can be done with this excellent instrument in the hands of the present Professor of Astronomy, while they also reflect credit on the Board of Trinity College for their large but wise expenditure.

W.

THE SUPPOSED FUNGOID ORIGIN OF CHOLERA *

THIS report contains a first instalment of the scientific portion of the Cholera inquiry now proceeding in India, the instructions for which were drawn up by the Army Sanitary Commission. It is limited to facts bearing on the Cholera theories of Hallier and Pettenkoffer. In the pursuit of these facts Dr. Lewis has been able to clear the ground for future progress, while at the same time he has added considerably to our knowledge on some obscure points of microscopical science. The report is fully illustrated with engravings of microscopic slides, executed with remarkable beauty and correctness in the office of the Surveyor General of India. Indeed whether we look at the engravings or the typography, we cannot help feeling that our own artists have something to learn from their brethren in India in these matters.

The subjects of examination are divided by Dr. Lewis into three classes. *Cysts*, *Spores*, and *Micrococcus*, the three elements of Hallier's theory; and the examinations have been conducted partly by direct observations of immediate choleraic discharges, in comparison with observations on other media, partly by the use of reagents, time and temperature, and partly by cultivation experiments. In this way, although the microscopic pathology of cholera has still to be inquired into, Dr. Lewis has been enabled to give a satisfactory account of a number of objects which have formed the bases of preceding theories. He has shown what these objects *are not*, and he has shown what many of them *are;* and this he has done with so much scientific caution that we cannot help feeling that this most important inquiry has fallen into proper hands.

In the year 1866 Hallier discovered in cholera discharges, yellowish-coloured cysts of spherical or oval form, enclosing yellowish shining spores varying in size, also groups of swollen spores surrounded by minute molecular matter (so-called *micrococcus*) proceeding apparently from the rupture or breaking up of spores.

These minute molecules were seen to adhere to various objects in the fluid, on which they appeared to feed; they exhibited signs of germination, groupings, filamentary arrangements, and, finally, branching filaments with *macroconidia* and *cysts*, the relations of which to each other were considered as established by cultivation experiments. The resulting fungus, a *polycystus*, was considered by Hallier to resemble the rye fungus in Europe, and probably to be present in diseased rice in India; and he held that this fungus introduced into the intestinal canal and there passing through the various stages of its existence, caused the phenomena of cholera by its action on the intestinal epithelium.

This brief sketch is sufficient to show how much solid fact was necessary to fill up the slight frame-work of Hallier's hypothesis. Here Dr. Lewis's work begins, and every step in it is illustrated by engraved slides.

We have first an examination into the nature of the so-called "cholera cells" discovered by Drs. Swayne, Brittan, and Budd, in 1849. These objects appear to have been of various kinds; some certainly not of fungoid origin. Selecting the most marked of the objects of which engravings are given, Dr. Lewis shows that objects, as nearly as possible similar to those figured by the Bristol observers, are found in discharges in India, and that they are ova of *acari* and of intestinal worms (*trichocephalus*).

As regards Hallier's *cysts* Dr. Lewis states that he has never met with any in fresh cholera discharges, but that he had repeatedly developed them. The other cyst-like bodies proved to be either fragments of tissues or ova, none being peculiar to cholera. Cultivation experiments with cholera discharge containing cyst-like bodies yielded branching fungi with *macroconidia*, which gave place to *aspergillus;* in other cultivations, however, the only products were *penicillium* and *aspergillus*. Dr. Lewis admits that cysts distinctly resembling those of Hallier may be developed by cultivation from cholera discharges, but that he had found them only three times in more than a hundred cultivations.

Their development is therefore not a constant phenomenon, and Dr. Lewis further shows that cysts of the same character can be developed in discharges not choleraic. Bodies resembling "*spores*" are very common in cholera discharges, and Dr. Lewis bestows much pains in demonstrating their true nature. He illustrates every step of the inquiry by slides, and classifies the bodies under the four following heads:—(1) Globules, of a fatty nature; (2) altered blood cells; (3) corpuscles, embedded in a tenacious substance; (4) globular condition of certain infusoria. The corpuscles in Class 3 are amœboid in character, and are probably due to effused blood plasma. There is no evidence of the presence of spores of fungi.

The last subject inquired into was the so-called micrococcus, the supposed "germ" of cholera, which in Hallier's view might pass into the human body in water or air, and then give rise to cholera by developing itself at the expense of nitrogenous material, especially intestinal epithelium.

Dr. Lewis shows that minutely divided matter is not more prevalent in choleraic than in other discharges, indeed less so, but that attempts to produce "*micrococcus*" by cultivation had entirely failed, possibly on account of the many sources of fallacy in such experiments.

He gives the results of a number of observations made with infusions and decoctions of animal matter, including cultivations with cholera discharge, and shows that in spite of every care in the manipulations, very different forms of life will make their appearance in substances derived from the same source, and under apparently identical conditions. His general conclusions on this first stage of the inquiry are:—

1. That no cysts exist in choleraic discharges which are not found under other conditions. 2. That cysts or "sporangia" of fungi are very rarely found under any circumstances in alvine discharges. 3. That no special fungus has been developed in cholera discharges, the fungus described by Hallier being certainly not confined to such. 4. That there are no animalcular developments, either as to nature or proportionate amount peculiar to cholera, and that the same organisms may be developed in nitrogenous material even outside the body. Lastly, that the supposed *debris* of intestinal epithelium is not of this origin, but appears to result from effused blood plasma.

Unless these conclusions are materially modified on subsequent inquiry, they must be considered as disposing of Hallier's theory of cholera. Should, however, Dr. Lewis's further investigations prove that Hallier's fungus is present in choleraic discharges and in diseased rice as a *constant*, we should still require scientific proof that cholera was caused by the action of this fungus and by nothing else.

Pettenkoffer's theory of cholera connects the prevalence of the disease with certain conditions of damp subsoil and subsoil water besides the presence of a "germ," favourable meteorological conditions and personal predisposition. Little has been done as yet in this portion of the cholera inquiry. What has been done is very interesting, although it does not support the theory. Observations regarding it have been made at Allahabad, Cawnpore, Lucknow, Fyzabad, Agra, Morar, Meerut, and Peshawur. The subsoil water experiments do not appear to sustain Pettenkoffer's views, but the examination of soils has yielded several important scientific facts of general interest. The amount of air in specimens of soil taken at different stations varies from 33 to 66 per cent.

* A Report on the Microscopic Objects found in Cholera Evacuations, &c. By T. R. Lewis, M.B., Assistant Surgeon H M. British Forces.

by measure. The amount of organic matter in soils, when compared with the amount, weight for weight in the water at the same stations is from 10 to 20 times greater; one instance is given in which it was 40 times greater. But the most interesting scientific facts are those connected with the development of lower forms of life in infusions of soils in water. Besides a few *algæ*, the prevailing forms are—*Monas lens, Paramecium, Monera* assuming the most fantastic outlines, *Vibriones, Amœba, Englenæ*, &c.

We look forward with great interest to further instalments of this important inquiry, which we trust may add largely to our knowledge, and by this means enable human life to be saved.

FOSSIL CETACEA

DURING the recent extensions of the fortifications of Antwerp, which have occupied some years, very fine opportunities have been offered, as is well known to geologists, for studying the Crag formations (Diestien and Scaldisien systems) of Antwerp, of which we have remnants on our own east coast. It is not however, so well known that the Belgian Government during the excavations used every care to preserve the remains of Cetacea and other marine mammalia thus disinterred. The workmen were instructed to give up all such remains for the Government, and were not allowed to sell them. Parts of the Black and Grey Crags proved to be a complete charnel house—so abundant were the remains—and these have been quietly brought together and placed under lock and key for the last eight years. The richness of the fauna disinterred may be judged from the fact that it is stated that eight new genera of Ziphioid Cetaceans are indicated besides sixteen new species belonging to known genera. Many of the forms are represented by far more complete portions of the skull than have hitherto been known from these beds, also portions of the trunk, limbs, and lower jaw in connection with these. Portions of the skull of the fossil Walrus, tusks of which occur in the Suffolk bone-bed and have been described as Trichecodon, have been obtained, as well as remains of seals. All these specimens are under study by the Vicomte du Bus, and are not open to the inspection of even professional palæontologists. They are being carefully and freely engraved, and will soon, it may be hoped, be made known to the world.

PARASITES

PROF. VON BENEDEN, as we have before noticed, has distinguished true parasites, which live *on* their host, from commensals, those which live merely *with* their host, the thieving impostor from the respectable lodger. In an admirable work on the "Fishes of the coasts of Belgium, their Commensals and Parasites," published by the Academy of Sciences of Brussels, he now further classifies parasitic organisms. The commensals are either 1, *Oikosites*, fixed; or 2, *Coinosites*, free. The Oikosites fish for their own living, and merely ask a free passage from their hosts. They are either fixed in perpetuity, as *Coronula, Cochliolepis, Modiolaria, Mnestra*, and *Loxosoma*, temporarily as the *Remora, Anilocra, Pranıza*, or only in the young state, *e.g.*, *Caligus* and *Anodon*. The Coinosites, on the other hand, never give up their liberty; they occasionally leave their host, and between Coinosite and host there is often an exchange of good offices, one furnishing a solid house or a strong claw, the other a sharp eye, and they may share their prey in common. The digestive canal is occupied by the following Coinosites:—*Fierasper, Stegophyle, Stylifer, Phronimus, Hyperia*, the mantle by *Pinnotherus* and *Pagurus*, the exterior by *Myzostoma, Cyamus, Pycnogonon Caprella*, and *Chætogaster*.

The true parasites cannot live without assistance, they are divisible into several categories. Some, such as the leech, fleas, and some dipterous insects, suck the blood of their victim, and then quit him to take their after-dinner nap in the open air; others, such as the ichneumon flies, do not quit their host till they have become adult, and have in the process exhausted the last drop of blood of their unfortunate prey. The greater number lead a free life when young, and merely attach themselves to a host at the time of reproduction, such are the Bopyrian and Lernæan Crustacea. There is a further very interesting group, who enter a host while yet young, simply in order that they may get carried by its means into a second host, where they will ripen their eggs. Often whilst waiting in their first host (sometimes vainly waiting no doubt) for him to be devoured by their second and ultimate victim they reproduce *agamically*. Such parasites are the Flukes and many Tapeworms. These divisions are thus tabularly set forth:—

Parasites free

during all their life.	during a part of their life they pass through		
	a single host.		several hosts whilst immature.
Leeches. Fleas and Flies. *Caliga.*	whilst immature. Ichneumons. *Mermis.*	when mature. Bopyrians. Lernæans.	Distomata. Cestoids.

The parasites of the first category which are free during all their life, Professor Van Beneden calls Phagosites, and compares them to the *habitués* of a hotel who avail themselves of the *table d'hôte*, but do not have a bedroom in the building. The other parasites which have both board and lodging are divisible into three principal categories. 1st. Xenosites—who are pilgrims in transit—voyaging with a distinct but distant object in view. They are always agamic, lodge in such closed organs as the brain, muscles, and serous membranes, and wait patiently till they get into the stomach of the animal where they are destined to breed. The stomachs and appendages of fishes swarm with parasites, and those which have the largest *clientèle* are by no means the least healthy or thinnest. Often one fish, having swallowed another, is swallowed by a third, and thus Xenosites find themselves set free in the wrong fish's stomach, for the stomach acts like a filter, straining out and retaining the parasites, while the flesh is digested. Such erring Xenosites merely wait, and may often pass through several "hotels" before they reach their destination. 2nd. Nostosites—those who have reached their destination, and now can abandon themselves to generation. Whilst the Xenosite was obliged to put up often with an uncomfortable cramped lodging, biding his time, the Nostosite occupies the most eligible organs for parasitism—in fact, the most vast and commodious chambers of the hotel. The 3rd division are the Pilgrims, who have lost their way hopelessly, and are in worse plight than even in Giant Despair's castle. Such are the agamic worms which are found often in the Plagiostomous fishes, and who ought to have got into some Teleostean fish, there to fructify—a happy fate for ever lost to them when by unlucky chance the host in whom they trusted was swallowed by a remorseless shark. They never quit this retreat

Professor Van Beneden gives directions for searching an animal for its parasites, and justly claims a high interest for the study of the fauna of individual species, and urges such neat and sharply-limited zoological inquiries on those who do not feel prepared to study the fauna of a geographical region—to the philosophy of which, indeed, the study of parasite-faunæ may furnish important suggestions. Ninety-three species of fish, with their parasites and commensals, are cited in this work from the author's own observation. Eight plates illustrate it.

E. R. L.

NOTES

In the second report of the Royal Sanitary Commission, just published, the Commissioners appear to be under the impression that no branch of science other than that of medicine is to any great extent involved in sanitary questions, and therefore recommend that the 4,000 medical men appointed under the Poor-law Board should be the inspectors under the proposed new sanitary department; mentioning, however, the probability of a variety of officers being requisite for scientific purposes only. We think that, in order to carry out sanitary reform efficiently, the new department should have the means of consulting the highest authorities in most of the branches of physical science, and here, as in many other cases, we see the necessity for a Board of Science, whose duty it should be to advise the Government on all scientific questions.

We regret to state that the work at the new buildings at Burlington House for the learned societies has come to a standstill, owing, we are informed, to the failure of the contractors.

Our Paris correspondent reports the death, at the age of 80, of M. Becquerel, the celebrated electrician. He died in Normandy during the siege of Paris.

The series of afternoon scientific lectures to be delivered in the Lecture Theatre of the Royal Dublin Society is as follows:—March 25—G. J. Stoney, A.M., on the Sun. April 1—Professor Traquair, M.D., on the Vertebrates of the Coal Period. April 8—Dr. C. Cameron, on the Source of Muscular Force. April 15—Professor J. R. Greene, on the Phenomena of Sleep and Dreams. April 22—Professor W. T. Dyer, on Recent Additions to our Knowledge of Fossil Plants. April 29—Professor T. Andrews, F.R.S., on the Continuity of Liquid and Gaseous States of Matter. May 6—Professor P. Redfern, M.D., Illustrations of the Advance of Physiology. May 13, Dr. J. E. Reynolds, on the Chemistry of Milk, and a new mode of testing its quality.

We are glad to hear that the Hackney Scientific Association is in an active and prosperous condition. In another column we print a very short abstract of a paper read at a recent meeting on the fossil remains of mammalia found in the Lea Valley.

The *Moniteur Scientifique*, edited by Dr. Quesneville, is the only scientific paper which continued to be published in Paris regularly throughout the siege. Since the 1st of October its circulation has been necessarily confined to its subscribers in Paris; but we have now received a parcel of ten of its fortnightly numbers, and heartily commend it to the notice of men of science in England.

The following is the substance of a communication on the periodicity and heliographic distribution of sun-spots, addressed by M. Zöllner to the *Astronomische Nachrichten* or March 2nd:—The sun-spots are slaglike by the radiation of heat on the glowing and liquid surface of the sun; the products of the cooling having again dissolved, in consequence of the disturbance of equilibrium produced by themselves in the atmosphere. When these disturbances are not only local, but generally distributed, the formation of new spots is but little favoured at the times of such general motion of the atmosphere, because then the most essential conditions of the surface are wanting for a severe depression of temperature by radiation, namely, the rest and clearness of the atmosphere. But when the surface has again gradually become quiet after the dissolution of the spots, the process again recommences, and acquires in this manner a *periodic* character, in consequence of the mean relationships of the surface of the sun, which may be considered as attaining an average in long periods. The distribution of the spots in area must, according to this theory, be determined by the zones of greatest atmospheric clearness, which, as has been shown, generally coincide with the zones of the greatest abundance of spots.

The following are our American notes for the week, for which we are again indebted to *Harper's Weekly*:—The eighty-fifth number of the Proceedings of the American Philosophical Society, lately published, and completing the eleventh volume, is, like many of its predecessors, nearly filled with important communications from Professor Cope, whose industry in publishing accounts of new, recent, and extinct zoological forms is untiring. One of the most important of these communications is an article upon certain fresh-water tertiary fishes from Idaho, collected by Mr. Clarence King, and embracing twelve species of six genera. These all belong to the Cyprinidæ, with the exception of one species of the trout family. With these fish were three species of *Astacus*, also described by Professor Cope in another communication.—We have already referred to one of the papers of Professor Cope, in which he describes a new species of mosasauroid, called *Liodon dyspelor*, based upon specimens from New Mexico in the museum of the Smithsonian Institution, and which, according to Professor Cope, probably exceeded one hundred feet in length, and may be considered as the longest reptile of which we have any account.—We have frequently called attention to the interest and value of the dredging operations conducted by Count Pourtales in behalf of the coast survey, in the deep seas adjoining the southern coast of the United States. The results of these labours are being published by the Museum of Comparative Zoology at Cambridge, Massachusetts; and there has just appeared an elaborate memoir upon the crustaceans by Dr. William Stimpson, of Chicago. A large number of new genera and species were detected in the collection, and a portion of these are numerated in the report referred to, which embraces only the Brachyura, the remaining families being reserved for a future memoir.—The Commissioners of Fisheries for the State of New York have lately announced in the public papers their readiness to furnish, free of expense, living black bass, cat-fish, white bass, rock bass, roach, perch, sunfish, and pike-perch, for stocking the waters in any part of the State of New York, provided parties desiring them will send an agent to receive and take charge of them. All of these are now bred at the State establishment at Caledonia, and applications for them are to be made to Seth Green, Rochester.—One result of the completion of the Pacific Railroad has been the introduction into Eastern markets of Western game. We see it stated that two hundred antelope were sent to Boston during a single week, and three hundred saddles of deer, of both the white-tailed and black-tailed species. The antelope brought from fifteen to twenty cents per pound wholesale, and the venison from twenty to twenty-five.

The first annual report of the Association for the Improvement of Geometrical Teaching has just been issued. Gentlemen who may desire to have a copy of the same, or to receive information on matters connected with the Association, will perhaps be glad to know the names of the local London secretaries, who are Mr. C. W. Merrifield, F.R.S., Royal School of Naval Architecture, South Kensington, and Mr. R. Tucker, M.A., University College School, W.C.

The Proceedings of the Royal Asiatic Society of Bengal for January contains a drawing of a remarkable case of polydactylism in a horse from Bagdad. Mr. Wood-Mason, who exhibited the specimen, remarked that the splint-like rudiments of the metacarpals of the fourth toe on each fore foot had given rise to a supernumerary digit provided with the regular number of phalanges, and encased in an asymmetrical hoof, the asymmetry of which was such that the presence of another of the same shape internally to it would have formed a symmetrical pair like

the cleft hoof of a ruminant. The metatarsals of the fourth toe on each hind foot were, by the law of correlation, similarly affected; but the supernumerary hoofs of these were stouter and more irregular in shape. The monstrosity appeared to present an interesting reversion in the direction of the extinct and fossil *Hipparion*.

ONE of the "A B C Despatch-boxes," patented by Jenner and Knewstub, has been forwarded to us. We hail it as a most useful invention for all who have papers to keep in order—a condition which largely obtains in the case of scientific men, and we commend it accordingly.

ON the night of the 26th January some severe shocks of earthquake were felt at Accra on the West Coast of Africa. As three series had been felt in five months there was considerable alarm.

MR. HYDE CLARK will bring before the Anthropological Institute on Monday the result of his researches on the ancient history of civilisation, and the development of comparative mythology in Western Asia and Europe, previous to the Aryan period.

COAL has been found at Sarawak in a district easy of access, and where native labour is easily obtainable.

INDIAN papers, in reporting an earthquake shock in Assam on January 27th, give two native theories of the causes and origin of earthquakes. The one is that when the world becomes sinful, a kind of large serpent, on which the world rests, turns on its side, and so causes them. The other is, that earthquakes are caused by periodical leaps of the mountain gods from one mountain to another.

THE Folkestone Natural History Society has issued its third annual report, from which we gather that its progress is still satisfactory. The number of members now reaches 150, showing an increase of thirty-two during the past year. The attendance both on field days and at the *conversazioni* has been, on the whole, very good. The expenses attendant on the reorganisation of the museum have been somewhat heavy, and an appeal is made for the formation of a museum fund, which it is hoped will meet with a suitable response. The report contains a selection from the papers read during the year, those published being: "On Primroses and their Fertilisation," by the secretary, Mr. Ullyett; "On Arctic Botany," by the president, Dr. Fitzgerald, who accompanied Lord Dufferin on his voyage to the North Pole some few years since; "On the Special Characteristics of Seaside Plants;" "On the Yeast Plant;" and "Local Botany." We are somewhat disappointed that more prominence is not given to local natural history; but, with this exception, the report is very creditable, although a little more attention might have been advantageously bestowed upon the printing of the scientific names. A list of the books given and lent to the library concludes the report.

DR. FAYRER, in India, has been experimenting to correct the popular error that a snake cannot kill a snake. He took a young and very lively cobra fourteen inches long, and which was bitten in the muscular part of the body by a krait forty-eight inches long. The krait had not bitten for some days before. From a detailed report by Dr. Fayrer, it appears that the cobra was bitten at 12.50 P.M., at 1 P.M. it was very sluggish, at 1.3 P.M. so sluggish that it moved with difficulty, could be easily handled, and made no effort at resistance. At 1.20 it was apparently dying and its movements were scarcely perceptible, and at 1.22 it died, thirty-two minutes after the attack. Dr. Fayrer has found that the water-snakes of India are deadly poisonous. In the Bay of Bengal they swarm, and it is noted as ominous that lately it was proposed to erect a sea bathing establishment for Calcutta at Parwar, under the assurance there were no sharks. It is remarked that sharks need not be noticed when a bather may have deadly water-snakes swimming after him.

THE *Correspondenzblatt* of the Naturalists' Society of Riga, 1870, contains an abstract of a paper by Herr Teich, "On the influence of climate on the size, colour, form, and number of species of butterflies:"—An account of a discovery by Prof. Nauch that thin glass tubes when they have a ball blown at their ends give out a distinctly audible and clear note on cooling so long as the relation of the size of the ball to the length of the tube does not pass a certain limit. The sound is ascribed to vibrations set up by the inrush of air consequent upon cooling. Some remarks by the same professor on a lightning tube found at Ilgezeem:—A long paper on cell life by C. A. Hengel:—A communication from Herr Thieme to the effect that he has found that *Dracæna paniculata* kills flies, particularly when the plant stands several feet from the window. The dead flies hang to the under side of the leaf:—A paper by A. Nöschel on the Trevelyan instrument, the sound produced by which he considers due to friction between the two metals—the one contracting, whilst the other expands, the vibratory movement being considered as secondary. The author calls attention to the fact that when the instrument has been in action for some time a bright spot is formed on the metal at the point of contact, which he considers as evidence in favour of his theory. Baron Horyingen Huene gives an account of a plan of sugaring for insects with apples cut in three soaked in solution of honey for a day, then strung on string, and suspended between adjacent trees, which he has found very successful. The journal contains many other communications, but without much original matter in them.

A REPORT comes from Bangalore in the Madras presidency, that coal and paying gold have been found.

AN Australian is said to have raised a sum of money by a false representation of the existence of coal at Midnapore in Bengal.

A SLIGHT shock of earthquake was felt at Guyaquil in Ecuador on the 9th January. The movement was from the interior towards the coast.

AN eruption of the Colorucco volcano in Mexico in January has done much damage to plantations and villages. An eruption of Mount Orizaba is expected.

ON the night of the 31st January an earthquake was felt at Bombay, which extended over a large tract of country. It is stated that on New Year's Day Northern Guzerat had a like visitation.

BESIDES the objects brought from the Guano Islands of Guanape, on the coast of Peru, by Mr. Josiah Harris, and exhibited at the Ethnological Society last year, we have now the report of a large find. The most interesting objects are rude representations of the human figure, cut in very hard wood. On the north island, beneath forty feet of guano, a cavity was come upon, which, on the removal of the guano, was found to be a cave, leading downwards further forty feet. This was a kind of Pompeii, but blocked with bird dung instead of volcanic ashes. It had been evidently frequented by man, and contained many handwrought works, and also well-preserved seafowl and other birds, lizards' eggs, but all petrified, as it were, in the guano. In many cases the colour of the eggs is preserved. The cracks and fissures in the walls of the cave were found filled with solidified ammoniacal salt. Two pieces of earthenware vases were found, bearing figures, also two gold earrings, and a bundle of medicinal herbs tied up in woven cloth. Local antiquaries consider the objects as far older than the time of the Spanish conquest. The point of interest is the accumulation of guano above the surface.

WE learn from the *British Medical Journal* that Dr. Crace Calvert, of Manchester, having been requested to carbolise a quantity of charpie for the use of the ambulances at the seat of war, found that charpie was unsuitable for the purpose; and after trying several textures, finally hit upon oakum as the most excellent. The oakum is first soaked in Burgundy pitch, and then rendered antiseptic by the addition of carbolic acid. This application has been a good deal used at the Manchester Infirmary, and with good results.

A NEW undertaking of interest to the philosopher is the Arequipa Railway in Peru just opened for traffic. It is a great engineering work, carried out with English capital by American enterprise, and it penetrates the western chain of the Cordillera of the Andes to reach the table lands of the interior, Arequipa, the terminus, being 7,800 feet above the level of the sea. Now at this elevation the rarefaction of the air is such that the ordinary workmen could not be employed, the suffering being in some cases intense. The works were, however, pushed on with vigour, and Mr. Meiggs imported above 16,000 labourers for his works, and for this purpose chiefly Aymara Indians from Bolivia. Mr. David Forbes, F.R.S., has, in his memoirs on the Aymaras in the Journal of the Ethnological Society, described the abnormal structure of the chests of these people, and it is astonishing to see them employed in a task which most effectually insures their subjugation. To foreign troops it was always difficult to scale these regions, but now the railway does the work, though to soldiers and passengers the journey is not always without discomfort.

THE Bunya-Bunya (*Araucaria Bidwilli*), a native of the northern district of New South Wales, is of considerable interest, as being the only hereditary personal property possessed by the natives, who greedily devour the fruit, either raw, or roasted and made into cakes. This fruit is only plentiful every third year; and at the proper season the aborigines assemble in considerable numbers for the purpose of obtaining it. Each tribe has its own set of trees, and each family its particular individuals among them; and these are handed down from generation to generation. The right of ownership is almost universally respected; but occasional depredations occur, when a fight ensues, the sympathies of the bystanders going with the lawful proprietor.

WE learn from the *Grocer* that experiments recently carried on in India have proved that coffee pulp will yield, upon distillation, 9 per cent. of its own weight of spirit, equal in strength to Scotch whisky. Nothing is said as to the flavour of this spirit in its raw state, but it appears to realise on the spot a price nearly equivalent to 4*s.* 6*d.* per gallon.

AT the end of January, no date named, a shock of earthquake was felt in the Sanjak of Kartal, in Northern Asia Minor, which lasted several seconds and did slight damage.

A LARGE and valuable deposit of limestone has been discovered by Mr. Read in the Sonthal Pergunnas, in Bengal, in the Banslo River. There is good communication with Calcutta by water or railway.

SOME fair pearls have been brought down to Durban, in Natal, from the River Vaal. They were found in mussels.

NATURAL history and dancing and the Police. Such is our announcement from Madras. In consequence of a fatal case the Commissioner of Police has ordered that the dancing girls shall not dance in the Hindu temples with cobra snakes thrown round their necks. This will cause great disappointment to the pious votary and the interested amateur. It will tend, however, to lessen the reverence for the cobra, and may bring his tribe into greater danger of repression.

IMAGINATION IN SCIENCE

PROFESSOR Tyndall will eventually have much to answer for. He has lent his authority to the admission of imagination in the pursuit of science, and there is every prospect that people whose imaginative faculty is stronger than their habit of observation will give us all plenty to do. We shall not only have to question nature, but we shall have to eliminate imagination, and thus have two battles to fight for truth. Our medical friends have not always walked in the ways of rigid observation and induction, but if any one desires to see how easy it is for the imaginative faculty alone to tell us all we require to know, we commend to his perusal the *Mobile Daily Register*, of Dec. 18th, 1870, in which there is a communication from Dr. Cochrane on the subject of yellow fever, well written, and interesting, and giving what may be called an account of yellow fever from the imaginative side. The author justifies his position by the example of European names, tells us candidly that he states only "what he believes but does not know," and then takes his flight into the unknown. He imagines "the yellow fever poison to be composed of living germs in innumerable number, living organisms of inconceivable minuteness, which eat, and drink, and multiply their generations under the sun, just as other living creatures do with which we happen to be familiar." He connects his speculations in these matters with similar speculations about "contagia" and disease "germs" which are well known on this side of the Atlantic, and without paying any attention to facts regarding yellow fever and other diseases which are left untouched by any extant doctrine, he tells us truly that "the visions of modern science are more wonderful than the visions of Eastern fable." This may be true, and the visions themselves may be true; but, for people who feel that they must walk over the earth in search of truth, nutriment of this kind is by no means sufficient for mental sustenance.

We have no desire to undervalue the importance of the imaginative faculty in scientific pursuits; but papers such as the one before us raise some very important primary questions. Are we to live, scientifically, in the same way as alchemists and astrologers did in the Middle Ages? and are we to ignore all that Bacon and Newton have done for us? If it be true that there is no royal road to knowledge on the firm earth, it is certain there is no such road through the air. Let us use the imaginative faculty by all means; but, in doing so, let us take our stand on the firm ground of the known before we venture ourselves into the unknown.

THE ROYAL SOCIETY'S SOIRÉE

WE are indebted for the following account of the most interesting objects exhibited at the Royal Society's *soirée* on Saturday evening last to the *Standard*, from which paper it is abridged.

In the foremost ranks of notable attractions were the heliotype process of printing photographic plates for plates for book illustration, by Messrs. Edwards and Kidd; the solar eclipse photographs, and the twelve-inch equatorial telescope, with its photographic feed apparatus (Mr. Browning's), by which they were obtained by Lord Lindsay; the musical vibration figures shown in Mr. Spottiswoode's new apparatus; the electrical experiments of Mr. Varley; Commander Harvey's sea torpedo (made by Vavasseur); Dr. Norris's soap-bubble experiments; Mr. Haviland's fine maps of the geographical distribution of cancer and heart disease (very recently published by Mr. Keith Johnston); the gold-hardening process, by Mr. Roberts of the Mint; and Mr. Francis Galton's pantagraph and resultant plates for the publications of the Meteorological Office.

The soap-bubble experiments, performed with great adeptness by Dr. Norris, were intended to illustrate the physical principles concerned in the formation of rouleaux in the blood and in the passage of the corpuscles *de toute pièce* through the walls of the minute blood-vessels, without rupture of the latter, as observed by Waller in 1846 and Cohnheim in 1867. A film of soap solution was taken by a metal ring of a foot or more in diameter,

and upon it a soap-bubble blown from a pipe was thrown; the bubble was caught by the film, and held suspended midway or along the equator of the thin hollow sphere. The bubbles were then forced through and drawn through without rupture of the films. An orange was dropped, and glass rods and other solid objects, with wetted surfaces, were passed in like manner without rupture of the films.

The three experiments by Mr. Cromwell F. Varley were exhibited for the first time in public. Two of them were in illustration of some investigations into the nature of electric discharges through gaseous media, described in a paper read before the society in January. In a Geissler's tube, containing highly rarefied hydrogen, a small filament of talc was hung by a single horizontal fibre of silk. Two aluminium rings, separated an inch and a quarter, formed the electrodes inside the vacuum. This tube was placed longitudinally with and over the horizontal poles of a large very powerful iron horse-shoe electro-magnet, made of a bar four inches in diameter and four feet in length, and wrapped with nearly 2 cwt. of thick copper wire. A small induction coil sent electric discharges from one ring to the other, producing a brilliant blue light around the negative pole, the positive pole being dark. The moment the magnet was charged, by means of thirty cells of Grove's nitric acid battery, each cell containing twenty square inches of platinum foil, the electric luminosity in the tube, which beforehand was diffused, gathered up into an arch extending one and a half inches beyond each ring, forming altogether a well-defined arch about four inches in length. This luminous arch follows exactly the course of those magnetic rays which traverse through the negative pole. By shifting the tube the piece of talc can be brought at pleasure in or out of this luminous arch. Neither the electric action nor the magnet *per se* produce any motion upon the talc; but when the tube is so placed that the luminous arch strikes against the talc the talc is repelled as much as 30° from the perpendicular. The electric current is passing simply from one ring to the other inside the tube, but the luminous arch in question where it strikes the talc is on the other side of the ring and where no electricity is flowing.

Mr. Spottiswoode's musical vibration experiment consisted of the visible representation of the forms actually assumed by a musical string when producing a note or its harmonies. To show this it is required that the string should be kept in a perfectly uniform state of vibration. This was very ingeniously accomplished by means of tuning forks kept in vibration by electro-magnets, these forming their own breaks in cups of mercury.

The singular action of nuclei in promoting crystallisation has long been known, but recent experiments by Mr. Chandler Roberts, chemist of the Mint, have imparted additional interest to the subject. Minute traces of lead, antimony, bismuth, or arsenic, render the alloy of gold and copper known as "standard gold" crystalline, intensely brittle, and totally unfit for the purpose of coining. This remarkable effect is produced even when the amount of obnoxious metal does not exceed the $\frac{1}{1000}$ part of the mass of standard gold. Mr. Roberts exhibited beautiful specimens of crystalline standard gold and illustrations of the process of toughening brittle gold by means of chlorine recently introduced in the Mint, the adoption of which has afforded a satisfactory solution to a question of considerable importance connected with the manufacture of coins.

SCIENTIFIC SERIALS

THE *Mittheilungen der naturforschenden Gesellschaft in Bern* for 1869, published last year, contain many important papers.—M. E. Schär publishes a valuable contribution to the knowledge of some cyanogen compounds, and a memoir of considerable length on peroxide of hydrogen, and its relations to ferments.—M. A. Gruner communicates a short but interesting paper on the luminosity of the so-called "touchwood," in which he details several experiments, and comes to the conclusion that ozone is to be regarded as the principal cause of the phenomenon.—In geology we find some valuable memoirs by M. C. von Fischer-Ooster, especially a paper on the Rhætic stage in the neighbourhood of Thun, which includes an account of the beds, and a list of the fossils occurring in them, with descriptions of some new species, and many figures. The same author also contributes several smaller papers on the occurrence of a Liassic zone between the chain of the Moleson and the Miremont in the Canton of Freiberg, on the narrow Flysch zone from the Hongrin towards Jaun, on the geological age of the so-called Tavigliana Sandstone, and on the stratigraphical conditions near the Küblisbad.—M. J. Bachmann publishes some remarks in opposition to M. Renevier's geological observations on the Alps of Central Switzerland compared with the Vaudoise Alps, and M. A. Rytz a notice on the erratic formations in the Kanderthal.—M. Theophil Studer notices the occurrence of Foraminifera in the Alpine chalks, detected by the examination of thin slices, and also describes a new Swiss form of the genus *Tropidonotus*, for which, however, he does not venture to propose a specific name.—Dr. R. Henzi reports upon the attempts made by him to cultivate *Saturnia Mylitta* and *S. yama maya*, and M. G. Hasler describes and figures an apparatus for giving telegraphic intimation of the height of water in reservoirs, &c.—The Proceedings of the society also contain short notices upon various subjects.

THE *Atti della R. Accademia delle Scienze di Torino* for the first six months of the year 1870 (vol. v. parts 3—7) contains numerous papers on various branches of science, but principally on subjects connected with physics. Of zoological memoirs we have a notice of some new and little-known species of birds collected on the voyage of the *Magenta* by MM. Giglioli and Salvadori, the new species being *Acridotheres leucocephalus* and *Leptoptila chlorauchenia*; a paper by Dr. Giglioli on the phosphorescence of the sea, with notices of the various animals observed by him to be luminous, and descriptions of two new species of the genus *Noctiluca* (*N. omogenea* and *N. pacifica*); descriptions of new species of birds by M. Salvadori, namely, *Saxicola allo-marginata* from the Sahara, *S. Brehmii* from Nubia and Abyssinia, *Brachypus urostictus* from the Philippines, and the type of a new genus allied to *Malacopteron*, *Homochlamys luscinia* (Finsch MS.) from the Philippines or China; and a critical revision of Antinori's descriptive catalogues of birds collected by him in North Central Africa.—M. Cavalli, in a memoir on a gunpowder uninjurious to cannon, maintains the superiority of large grains, especially if made spherical and more regular and hardened at the surface.—A new form of mercurial barometer is described by M. Faà di Bruno, and the barometric formula of Count Paolo de Saint-Robert is discussed by Prof. Dorna, who also presents what he calls a loghypsometrical table for use in applying the barometric formula worked out by him in the determination of altitudes.—Prof. Govi describes a new method of obtaining sensitive flames, consisting in the application of a wire net with meshes about one millim. square to an ordinary gas jet, and lighting the gas after its passage through the meshes. The same author also publishes a note on the influence of sonorous vibrations upon cold and ignited gas jets.—Prof. Boccardo notices the fall of an earthy shower at Genoa on the 14th February, 1870. He gives an analysis of the material, which consisted chiefly of sand with oxide of iron and carbonate of lime, and contained 6·611 per cent. of nitrogenous organic matter. Under the microscope, it was found to contain frustules of Diatomaceæ and fragments of other simple Algæ. No windstorm had occurred immediately before the fall of the shower, which the author considers to have probably come from Egypt.—Prof. Dorna has a note on the scientific importance of Soperga and the Sacra di San Michele to the Observatory of Turin, and upon their respective differences of level.—M. Richelmy communicates some notes on the construction and operation of toothed wheels.—In a paper on nitroglycerine, nitromannite, and pyroxyline, Prof. Sombrero vindicates his title to be regarded as the discoverer of the first of these compounds, and notices the properties and mode of preparation of the other two. M. L. F. Menabrea furnishes some explanations of his views on the principles of elasticity, which are disputed by MM. A. Parodi and G. Barsotti. M. Codazza describes an apparatus devised by him to act as an electrical indicator to give notice of the attainment of the maximum or minimum limits of temperature between which it is required to keep any substance. Prof. Denza describes an aurora borealis observed in Piedmont on the 5th April 1870.—Prof. Govi indicates that Thenevot was the inventor of the spirit-level with a bubble of air. The same author communicates a paper by Prof. Chiò on a barometric formula.—M. Gastaldi notices a collection of stone weapons and instruments from the neighbourhood of the Baltic, and also some ancient weapons and instruments of stone, bronze, or brass, from Egypt. Several of these are figured; one of them, a long, chisel-shaped, bronze instrument, is attached obliquely to a mallet-shaped handle, in such a manner as to serve as a small axe.—Prof. Luvini publishes a long paper on the adhesion between solids and liquids.—M. Genocchi notices some papers ascribed to A. Cauchy.—Prof. Dorna describes the instruments and methods employed at the Observatory of Turin for the measurement of time.—M. A.

Gras communicates a paper on some botanical synonyms. The plants referred to in the last-mentioned paper are *Lindernia palustris* Crantz, anterior to *L. pyxidaria* Linn., and identical with *Anagalloides procumbens* Krock.; *Scirpus quinqueflorus* Crantz; *Stellaria graminea* Linn.; *Galeopsis segetum* Neck.; *Euphorbia sequieriana* Neck.; and *Statice cordata* Linn., said to be distinct from the species so named by Gusson, which is here noticed as *Statice Gussonii*.

THE Proceedings of the Bohemian Society of Sciences contain several papers by M. Emil Weyr on subjects belonging to the higher mathematics, the titles of which it would be useless to give here. One of his papers, however, is on the curves of maximum and minimum electro-magnetic action.—Dr. A. Grünwald also communicates a paper on some differential equations with variable coefficients, and Prof. Blagek a short notice on the triaxial ellipsoid. The titles of several natural history papers are given; one by Dr. Schöbl on the termination of the sensitive nerves in newly-discovered terminal corpuscles in the wing membrane of the chiroptera, and on the minute structure of the membrane is printed in full. This paper has appeared with illustrations in Siebold and Kölliker's "Zeitschrift für wissenschaftiche Zoologie."—A short notice is given of a lecture by M. Wocel on the significance of stone and bronze antiquities in the primitive history of the Sclavonic tribes, founded on the study of a large collection of casts of such objects from the Ural, Altai, Caucasus, &c.

THE *Verein für Erdkunde* in Dresden published last year its sixth and seventh annual reports, including its proceedings for the sessions 1868–69, and 1869–70. The abstracts of proceedings contain a multitude of short notes upon the results of travels made by members of the Society, and a report upon the doings of the sections of the Society in furtherance of its objects. Besides these, we have in an appendix three memoirs of some importance, namely, contributions to the knowledge of the Hottentots, by M. T. Hahn, relating especially to the language of the "Nama" tribes, but containing besides much interesting matter; a geographical sketch of the Murray and Darling district in Australia, by Dr. H. Beckler; and a curious contribution to the history of geography during the latter half of the Middle Ages, giving an account of the maps and charts of the seafaring peoples of Southern Europe up to the first printing of Ptolemy's Geography, by M. Heinrich Wuttke.

SOCIETIES AND ACADEMIES

Royal Society, March 9.—"Results of Seven Years' Observations of the Dip and Horizontal Force at Stonyhurst College Observatory, from 1863 to March 1870." By the Rev. S. J. Perry.

The object of the present paper is to bring further evidence to bear upon an important question of terrestrial magnetism.

The existence of a sensible semi-annual inequality in the earth's magnetic elements, dependent on the position of the sun in the ecliptic, was deduced by General Sir Edward Sabine from a discussion in 1863 of a continuous series of the monthly magnetic observations taken at Kew. A previous reduction of observations made at Hobarton and at Toronto had first suggested the idea, and a new confirmation of the results has lately been obtained by Dr. Balfour Stewart from subjecting a second series of Kew observations to the same tests as before. The observations, which form the basis of the present discussion, extend over the period from March 1863 to February 1870, during which time the same instruments have been in constant use. These are a Jones unifilar and a dip-circle by Barrow, both tested at Kew, and a Frodsham chronometer. Sir Edward Sabine, who made the Stonyhurst Observatory one of his magnetic stations in the English survey in 1858, greatly encouraged the undertaking of monthly magnetic observations, and the Rev. A. Weld procured in consequence the instruments still in use. Only occasional observations were made with these instruments for some years, and it was only in 1863 that a continuous series of monthly determinations of the magnetic elements was started by the Rev. W. Sidgreaves. He observed regularly until September 1868, when I returned to my former post at the Observatory, and have continued the same work ever since.

A stone pillar was at first erected for the magnetic instruments in the open garden, and this remained in use from 1858 until the beginning of 1868, when a most convenient hut of glass and wood was built for the instruments in a retired corner of the College garden. This alteration was rendered necessary from the placing of iron rails in the vicinity of the old pillar; and although it introduces into the results a correction for change of station, it has the great advantage of securing immunity from disturbance for the future.

Considering the object in view in drawing up this reduced form of the dip and horizontal-force observations, I have judged it advisable to adhere strictly to the tabular forms in which the matter has been presented in previous discussions of a similar nature. Each element is the subject matter of these tables. In the first are the monthly values of the element, the deduced mean value, and its secular variation. Next in order comes the calculation of the semi-annual inequality. The residual errors, and consequent probable weights of the observations and results, compose the third and last table.

The yearly mean values of the horizontal force are found to vary progressively from 3·5926 to 3·6178 in British units, the mean for Oct. 1st, 1866, being 3·6034, with a secular acceleration of 0·0042. Calculating from the monthly tables the mean value of the horizontal force for the six months from April to September, and for the semi-annual period from October to March, we find the former to be 0·0005 in excess over the latter, showing that this component of the intensity is greater during the summer than during the winter months. Treating the dip observations in a precisely similar way, we obtain 69° 45′ 21″ as the mean value of this element for October 1st, 1866, subject to a secular diminution of 1′ 49″·2; the extreme yearly means being 69° 48′ 47″ and 69° 37′ 52″. The resulting excess of 10″ for the winter months in the computed semi-annual means is so small, that the observations tend mainly to show that the effect of the sun's position is not clearly manifested by any decided variation in the dip. Deducing the intensity from the above elements, we obtain for the summer months the value 10·4136, whilst that for the winter months is 10·4128. The intensity of the earth's magnetic force would thus appear to increase with the sun's distance, but the difference is not large enough to have more than a negative weight in the question under discussion. This weight, moreover, is lessened by the slight uncertainty arising from the probable disturbing causes at the first magnetic station.

It is hoped that a second series of observations at the new station will throw greater light on the fact of the sun's influence on terrestrial magnetism, by either confirming the results obtained above, or by adding fresh weight to the conclusions arrived at by the President of the Royal Society.

"Preliminary Notice on the Production of the Olefines from Paraffin by Distillation under Pressure." By Dr. Thorpe and John Young.

"Contributions to the History of the Opium Alkaloids. Part I.—On the Action of Hydrobromic Acid on Codeia." By C. R. A. Wright, D.Sc.

Mathematical Society, March 9.—Mr. W. Spottiswoode, F.R.S., president, in the chair. Mr. C. R. Hodgson, B.A. Lond., was elected a member: and the following gentlemen were proposed for election:—The Hon. J. W. Strutt, Major F. Close, R.A., and Mr. James Stuart, Fellow and Assistant-Tutor of Trinity College, Cambridge. Two models of surfaces were exhibited by Prof. Henrici, which had been exhibited and described at previous meetings of the society. Prof. H. J. S. Smith, F.R.S., read a paper on "Skew cubics." The secretary (Mr. Tucker) then read a communication from Prof. J. Clerk Maxwell, F.R.S., entitled "Remarks on the Mathematical Classification of Physical Quantities." The classification referred to was founded on the mathematical or formal analogy of the different quantities, and not on the matter to which they belong. Thus a finite straight line, or force, or velocity of rotation, &c., are quantities, differing in their physical nature, but agreeing in their mathematical form. The two methods of classification, the one just referred to and the obvious classification founded on that of the sciences in which the quantities occur, may be distinguished by calling the first a mathematical and the second a physical classification of quantities. The secretary afterwards read a "Note on the History of certain Formulæ in Spherical Trigonometry," communicated by Mr. I. Todhunter, F.R.S., in which the formulæ usually known as Gauss' Analogies were claimed for Delambre. Dr. Hirst presented ten "Memoirs by M. Chasles" to the library of the society.

Entomological Society, March 6.—Mr. A. R. Wallace, president, in the chair. Baron de Selys-Longchamps was elected an honorary member, the Rev. T. A. Preston an ordinary

member, and Mr. G. C. Champion a subscriber. Mr. Jenner Weir exhibited a small collection of butterflies from Madagascar. Mr. F. Smith exhibited two small branches of ash, from which a hornet had been observed in the act of removing the bark. He said that Réaumur had recorded a similar observation, and was of opinion that the insect was trying to reach the sap for food, and was not obtaining building materials. Mr. Smith further made some remarks on the disputed luminosity of Fulgora, and expressed himself in favour of the opinion that these insects are occasionally luminous.—Mr. Müller read notes on a gall-making Cecidomyia upon *Campanula rotundifolia*.—Mr. Lewis called attention to cases of antennal malformation in Lepidoptera.—Mr. Butler exhibited forms of *Cænonympha Satyrion* from the opposite sides of the Gemmis, showing marked variation.—Dr. Sharp communicated notes on some British species of Oxypoda.—Mr. Lowne read a paper on "Immature sexuality in insects." The author thought that species sometimes originated from the maturity of the sexual organisation before the acquirement of adult characters; a conclusion he had arrived at in consequence of the early development of the organs in the embryo and larva. He further stated that, in his opinion, the larval and pupal conditions were probably acquired, and not direct, stages of development.—Mr. Briggs detailed experiments upon Lepidoptera, undertaken with a view of testing if the numerical proportion of the sexes, or sex itself, were dependent upon the food of the larva; the results negatived such suppositions.

Zoological Society, March 7.—Prof. Flower, F.R.S., in the chair. Mr. P. L. Sclater read the first part of a series of "Notes on rare or little-known animals now or lately living in the Society's Gardens."—These he had drawn up while engaged in preparing a new edition of the List of Vertebrated Animals in the Society's collection.—Dr. A. Günther read a List of the known Lizards belonging to the family *Sepidæ*, to which were added notes on some of the species.—A communication was read from Mr. F. Moore on some new species of Insects collected by Dr. John Anderson, during the recent expedition to Yunan.—A communication was read from Mr. A. G. Butler, containing descriptions of some new species and of a new genus of Diurnal Lepidoptera of the family *Pierinæ*, with a monographic list of the species of the genus *Ixias*.—Mr. A. D. Bartlett, Superintendent of the Society's Gardens, read notes on the birth of the Hippopotamus which had lately taken place in the Society's Gardens.

Hackney Scientific Association, February 28.—"The Fossil remains of the Mammalia found in the Lea Valley," by Mr. R. E. Olliver. Some extensive excavations in this district have recently exposed to view numerous beds of shell-marl, peat, loam, sand, and gravel, and, what is more interesting, have brought to light the remains of an ancient mammalian fauna. These remains chiefly belong to living species, as may be inferred by the deposit being assigned to the Post-Tertiary epoch. The mammalian remains which have up to the present time been determined are—Human remains, wild horse, red, fallow, and reindeer, elk, beaver, fox, wolf, goat, great fossil ox, Celtic short-horn or small fossil ox, domestic ox, wild hog, gigantic round-antlered deer, mammoth, great cave bear, and the remains of an ox closely resembling *Bos longifrons*, which the writer strongly suspects to belong to a disputed series named *Bosfrontosus*. The fossil bones attesting the existence of these mammalia are found principally in the shell-marls and peat mosses, with the exception of the mammoth, cave bear, and great round-antlered deer, which are found in the grey sub-angular gravels, and rarely at a less depth than ten feet from the surface. The human remains, consisting of several skulls, possibly belong to that class named by Prof. Huxley the river-bed-skull. These skulls certainly belong to that period when the great fossil ox and elk were living, and not to that of the mammoth and cave bear. If, however, the evidence of the workmen is reliable, several skulls were found at a depth of thirty feet.—"A Catalogue of Variable Stars, with remarks upon their physical constitution."

CAMBRIDGE

Philosophical Society, February 27.—Communications made to the Society:—By Mr. W. H. H. Hudson, St. John's College, "On Observations made at San Antonio on the Solar Eclipse of Dec. 22, 1870." By Mr. Clifford, Trinity College, and Mr. Moulton, Christ's College, "On the Solar Eclipse of 1870." Mr. Hudson described the observations made at San Antonio during the eclipse, and with regard to his own with the polariscope came to the following conclusion: that observations of polarisation made with telescopes not specially prepared for the process are worthless, and that such polarisation of the corona as he was able to detect was due to the intervening atmosphere; appearances of polarisation being produced when light shines through a thin cloud. Prof. W. G. Adams exhibited with the lime light some photographs of the corona, and commented upon them. Mr. Clifford, who had been with the Sicilian party, described his experiences, and differed to some extent from Mr. Hudson as to the instrumental defects and the absence of polarisation: while Mr. Moulton corroborated Mr. Hudson's conclusions, and read a very interesting communication from Father Perry, summing up the results of the spectroscopic observations at the various stations.

WINCHESTER AND HAMPSHIRE

Scientific and Literary Society, February 22.—The Rev. G. A. Seymour, M.A., and Beresford N. Earle, M.A., M.B., Fellow of the Cambridge Philosophical Society, were elected members. There was a good show of objects of interest in natural history, amongst which, exhibited by the president, was a collection of British land and fresh water shells, and a specimen of recent chalk dredged by Dr. Carpenter from a depth of 2,435 fathoms in the Atlantic. Microscopic slides of the same were exhibited by Mr. F. I. Warner, showing the unbounded amount of animal life at that enormous depth. Dr. Heale showed, under the microscope, the curious movement of the spiral vessels of the Collomia seed.—The Rev. W. Awdry, M.A., read a learned and interesting paper entitled "Some Ideas worked out in Gothic Architecture."

GLASGOW

Geological Society, February 2.—Mr. John Young, V.P., in the chair. "On the Boulders found in Cuttings on the Beith Branch Railway, considered in Relation to their Parent Rock; with observations on the local character of the Boulder Clay," by Mr. Robert Craig. The lines of railway referred to, now in course of formation, run nearly south-east from Beith, changing as it reaches Waterland to direct east. The striations upon the glaciated rock-surfaces in the district have a general bearing, per compass, of nearly N.E. to S.W.; the line accordingly, at its western terminus, crosses them almost at right angles. The cuttings run nearly parallel to the southern termination of that range of trap hills which extends from Gleniffer to Beith, and at the distance of little more than a mile from it. The carboniferous strata crop out along the southern boundary of this trap range, and consequently about a mile to the north of the railway. In the trap range four well-marked varieties of porphyrite occur, which, with the easily distinguished beds of the Carboniferous limestone, gave the geologist an opportunity of classifying the boulders and tracing them to their source with an exactitude not always attainable. Mr. Craig then referred to the boulders from a distance, consisting of Old Red sandstone, clay slate, mica and chlorite schists, quartz, gneiss, granite, found associated and intermixed with the local boulders. Of these the Old Red sandstone figures highest, and consists of two varieties—one of a highly red colour, the other of a dark grey. Both of these are found *in situ* along the shores of the Firth of Clyde, and in other parts of Scotland, flanking the Highland mountains. He considered these erratics might be accounted for without either drift-ice or submergence, simply by the operation of land-ice, or glaciers, bearing these fragments in passing from the Highland mountains, whose tops, many of them, would be 1,000 feet above the ice, even allowing the sheet to be 2,000 feet thick. It was well-known that ice, in moving over uneven ground, became rent into fissures and crevasses, down through which the stones it was carrying on its surface found their way to the bottom, and thus became mixed up with the "foot-board moraine." In further proof of this, he gave the highest points above the cuttings whence the local boulders could have been derived, showing that these boulders could not have fallen upon the surface of an ice sheet thicker than 200 feet; and, besides, that many of them came from beds scarcely higher than the position in which they are now found. The perfectly local character of the boulder-clay, with the exception of the erratics, he thought was demonstrated; and from some sections in which he had followed the course of the ice-stream, he found that there was a change in the boulders every three to five miles, less or more, according to the roughness or evenness of the ground.—A collection of phosphates from Charleston, U.S., was exhibited by Mr. Potts and Mr. Naismith, together with some large fossil teeth, vertebræ, &c., from the same locality. Mr. Potts stated that large quantities

of these phosphates are being used in America, and also imported into this country, for the manufacture of artificial manures. The deposit from which they are taken is found along the banks of many of the rivers in South Carolina, and immediately under the surface soil of the land lying between; and is supposed to underlie a large portion of the coast and sea-island region of that part of America. It consists of layers, varying six inches to several feet in thickness, of irregularly rounded nodules, mixed up with an immense quantity of bones—ribs, vertebræ, tusks—of various species of animals, all more or less petrified. The nodules yield 50 to 60 per cent. of bone phosphate; while from some of the bones as much as 80 to 85 per cent. of this fertilising substance had been obtained. The Chairman said there could be no doubt this remarkable deposit of phosphates belonged to the Tertiary period; and probably its earlier division, the Eocene. The Tertiary formation is largely developed along the southern coast of North America, stretching in a belt of considerable breadth from North Carolina to the Gulf of Mexico, and leaving the coast-line only at the delta of the Mississippi. The whole series of fossils, like those before them, indicated a much warmer climate than now prevailed in that part of the world, and showed that the waters of the sea were teeming with large and powerful forms of life.

Dublin

Royal Dublin Society, February 20.—Dr. Croker King in the chair. Prof. Macalister delivered a discourse "On Recent Advances made in Comparative Anatomy." He alluded to the investigations of Kowalersky published in the Transactions of the Imperial Academy of St. Petersburg as to the relationship that exists between the Ascidians and Vertebrates; also to the many recent investigations into the comparative myology of the upper and lower extremities, and alluded to a very simple yet neat nomenclature of the muscles of these parts.

Natural History Society, March 1.—Rev. Dr. Haughton, F.R.S., in the chair. A paper was read by Mr. G. H. Kinahan on ferns observed in Yar or West Connaught, the part of Co. Galway that lies west of Loughs Mask and Corrib, with localities of a few rare ferns in south-west Sligo.—Mr. W. Andrews read a paper, "Notes on the Ichthyology of the South-West Coast of Ireland." It is always of interest to bring to notice any new facts either in the zoology or botany of a country or district, but more especially so when any discovery can be recorded which presents new features of animal or vegetable life, the existence of which had not been previously known. The chief remark conveyed in this paper is with reference to the capture in January last on the south-west coast of several specimens of a fish of extremely rare occurrence, the *Trichiurus lepturus*; the occurrence of *Centrolopus pompilus* in numbers off the coast of Dingle was also mentioned, and also that of a fine specimen of the tunny caught in Brandon Bay, October 1869. The author gave many details as to the structure of the *Trichiurus*, and concluded with stating that he felt confident that we have not yet gleaned the extent of interest that exists in the marine zoology of our shores, or of the deep water of our coasts.

Royal Zoological and Geological Societies of Ireland, March 8.—Prof. Hull, F.R.S., in the chair. The Rev. Dr. Haughton, F.R.S., read a paper on the Mechanism of Flight in the Albatross (*Diomedea exulans*), considered in relation to its muscular anatomy.—Prof. Macalister read a paper on some Parasites found on Animals from the Dublin Zoological Gardens.—Rev. Dr. Haughton made some remarks on the recent death of four lion cubs in the Society's gardens.—Prof. Traquair exhibited a collection of carboniferous ganoid fishes from Wardie, in Scotland.

Halifax, Nova Scotia

Institute of Natural Science, February 13.—J. M. Jones, F.L.S., President, in the chair. Dr. Honeyman, F.G.S., read a paper, "On the Geological Formation of the Picton Coal Field," which was a continuation of his record of geological discovery in Nova Scotia, delivered at the November meeting of the Institute. The present paper showed that the Devonian was absent, and that the underlying formations were Upper and Middle Silurian, arranged in several anticlinals, synclinals, and monoclinals. The lithological character of these formations at the time of the deposition of the overlying Carboniferous strata was as it now exists. The strata were more or less metamorphic, and the system of folds was, as has been indicated, and were washed on the north, south, and west, by the seas of the Carboniferous period. Lower Carboniferous conglomerate and grit succeeded by gypsum were deposited on Lower Helderberg strata (Upper Silurian), highly fossiliferous at Irish Mountain. Argillaceous shales with overlying limestones were formed on Lower Helderberg strata (very fossiliferous), and rather higher in the series than the strata of Irish Mountain. In Springville there are two localities where the Silurian strata on the same horizon as Irish Mountain (possibly a little lower) are overlaid *directly* by Lower Carboniferous limestone. Farther up the river there are three localities where Lower Carboniferous limestone overlies Silurian strata; in two cases, a breccia is formed with the limestone and metamorphic slates belonging to the lowest part (or nearly so) of the Middle Silurian age. In the remaining case, in the river at Pleasantville a great band of Lower Carboniferous limestone lies unconformably on Lower Helderberg or Upper Silurian, highly metamorphic. In Cross Brook, Irish Mountain, Lower Carboniferous sandstones with limestone overlie Clinton strata of the Irish Mountain Silurian series with fossils, and also the denuded axial greenstone. At McLellan's Brook, Lower Carboniferous grits succeeded by limestone come up against the back of Clinton strata of the other side of the Irish Mountain anticlinal. At the lowest falls of Sutherland's River, Lower Carboniferous conglomerate comes up against the back of the Medina slates, metamorphic, apparently non-fossiliferous of Wier's Mountain of the monoclinal series. Higher up Sutherland's River at McPherson's is the passage from the Picton into the Merigomish Carboniferous area. Here Lower Carboniferous grits containing a brine spring come up against the back of Medina strata, very little altered with characteristic Petraia and Lingulæ. These are succeeded by Clinton shales with cone in cone concretions and lingulæ nodules in abundance. In this district are two mountains with porphyry. Conglomerate, grit, argillaceous shale, and limestone of Lower Carboniferous age, have thus been formed contemporaneously. Then succeed alternations of sandstone and limestone and gypsum. Thus are formed limited areas of limestone in different geological positions and entirely disconnected. The order of formation of the representative beds of limestone appears to be as follows:—1. The Black pyritiferous limestone in closest contact with the Lower Helderberg slates having obscure brachiopoda visible, particularly by weathering. 2. The Lithostrotian limestones of Springville and McLellan's Brook. 3. Limestone strata with intercalary shales, below Springville Factory on the river, highly fossiliferous, containing Orthocera, Bellerophon, Gasteropoda, Conchifera, Crinoidea, and Fucoids. 4. Thick bedded limestone formed of an agglomeration of minute Conchifera and Crinoidea. Above this are strata with teeth of cochliodus. This limestone appears to be of the same age as similarly formed limestones on the West Branch having Conularia. In the Silurian formation on separate anticlinals are—1. An apparently valuable bed (?) of limonite. 2. A bed of fossiliferous iron ore of considerable thickness. 3. Pockets of specular iron ore. These, although separated, are of the same geological age—Clinton. The Medina and Lower Helderberg strata of the area examined, in their passage across rivers and brooks, form numerous waterfalls, some of which are mill sites. Fine exposures of Lower Helderberg fossiliferous strata in McLellan's Brook and Sutherland's River, form the foundation of a mill dam in the brook and formidable rapids in the river. The Picton Coal Field is well known through the writings of Dawson and others. Its thick coal seams have been represented by columns in the International Exhibitions of London, 1862, Dublin, 1865, Paris, 1867. In the discussion which followed, the President called attention in an interesting zoological fact mentioned by Dr. Honeyman to one part of his paper, viz.—the common cattle of the neighbourhood in which he had found a brine spring, resorting to such fountain and greedily drinking its waters. The same habit was also to be observed in the wild buffalo of the western prairies, which annually resorted to certain well-known "salt licks" for a similar purpose.

Berlin

Berlin Society of Anthropology, Ethnology, &c.—Prof. Virchow continues (*Zeitschr. für Ethnologie*, 1870, vi.) his communications on the subject of the urns with sculptured faces, already treated by himself, by Nilsson, and by Kupfer; and also read a paper on "Settlements belonging to the Stone age in Nieder-Lausitz," &c., and a third on a visit to the Westphalian bone caverns. Among the same transactions may be noted a letter from Fisch on the *Framea*, in which he derives the word from the old Gothic *fram* (the English

from) and explains to mean a weapon thrown *forwards*,—*telum missile:* the subject was again discussed at a late sitting (*ib.* iv. p. 347). A paper was read by V. Martens on the implements used by the Dyaks of the interior of Borneo: a letter from Kupfer on the remarkable vases with human faces which were the subject of Virchow's communication to the same society last March; and a long paper, with woodcuts, on the vitrified stone sites of Oberlausitz by Prof. Virchow, which shows with what accustomed ability the great pathologist pursues the inquiries which amuse his holidays.

PARIS

Academy of Sciences, March 6.—M. Henry Sainte-Claire Deville proposed to his colleagues to enlarge the scope of their proceedings, and to deliberate upon any subject relating to social matters which can be promoted through the instrumentality of science. This idea was warmly advocated and supported by M. Bouley, M. Dumas, and others, and met with only one opponent, M. Combes, general inspector for Ponts-et-Chausées, who said that such a step was contrary to the rules of the Academy, and that the Academy besides had no right to pronounce on a communication from its own members. But ultimately the discussion of the proposition was referred to a secret committee, which is to be held probably next week. This sitting was rife with discussion.—M. Faye having referred to a special committee the project of a railway to be constructed between America and Europe through the Aleutian Islands, General Morin protested, saying it was merely wasting time to refer such wild schemes to members, and that the committee was, at all events, not bound to give any opinion at all. In spite of this protest, M. Faye referred the communication to a member in order to know from him if it was worth being sent before a special commission.—M. Delaunay and M. Bertrand disputed what was the precise opinion of M. Hopkins on the thickness of the solid crust of the earth. M. Delaunay said moreover that calculations proved it had no influence on the revolution of the earth, as no movement of the internal fluid could possibly have any effect whatever.—M. Bouley declared that the flesh of animals infected with the cattle plague was not unwholesome for food. It is true that such flesh is served out to poor people supplied from municipal benevolent institutions. But such is not the view taken by the paying public, as the purchase of beef is falling, and the sale of mutton or pork increasing daily. The rinderpest is raging so severely in the herds destined for the revictualling of Paris, that very often carts loaded with carcasses are seen passing through the streets of the city.—M. Janssen was present at the sitting, and he is going to London, where he will arrive by the end of the present week. Many of the *francs-fileurs* have resumed their seats without any remark having been passed upon them. M. Becquerel the elder, the celebrated electrician, died in Normandy during the investment of Paris. He was about 80 years of age. The water-tubs and towels disposed in case Prussian shells should set fire to the building have not yet been removed from the hall.

BOOKS RECEIVED

ENGLISH.—The Natural History of the Strait of Magellan: R. O. Cunningham (Edmonston and Douglas).—The Story of Aristæus and his Bees: R. M. Mullington (Longmans).—A Few Poems: E. Smith (Dunn and Fry). The Ancient Geography of India: A. Cunningham (Trübner and Co.).—The Chronological History of Animal Plagues from B.C. 1490 to A.D. 1800: G. Fleming (Chapman and Hall).

FOREIGN.—(Through Williams and Norgate)—Die elektrische Doppelhebel: J. N. Czermak.—Untersuchungen aus den Institute für Physiologie u. Histologie in Graz 2tes Heft: A. Rollett.—Echinologie Helvétique: Désor et de Loriol.

DIARY

THURSDAY, MARCH 16.

ROYAL SOCIETY, at 8.30.—Description of Ceratodus, a Genus of Ganoid Fishes, recently discovered in Rivers of Queensland, Australia: Dr. Günther, F.R.S.—On the Formation of some of the Sub-axial Arches in Man: G. W. Callender.

SOCIETY OF ANTIQUARIES, at 8.30.—On Photographs of Armenian Antiquities: Captain Lynch.—On an Undescribed Expedition to Britain in the Reign of Augustus: W. H. Black, F.S.A.—On certain inscribed leaves of lead in the British Museum: W. De Gray Birch.

LINNEAN SOCIETY, at 8.

CHEMICAL SOCIETY, at 8.

ROYAL INSTITUTION, at 3.—Davy's Discoveries: Dr. Odling.

LONDON INSTITUTION, at 7.30.—On the Colonial Question: Prof. J. E. Thorold Rogers, M.A.

FRIDAY, MARCH 17.

ROYAL INSTITUTION, at 9.—On the Eclipse: J. Norman Lockyer, F.R.S.

ROYAL COLLEGE OF SURGEONS, at 4.—On the Teeth of Mammalia: Prof. Flower.

SATURDAY, MARCH 18.

ROYAL INSTITUTION, at 3.—Spirit of the Age: Mr. O'Neil.

SUNDAY, MARCH 19.

SUNDAY LECTURE SOCIETY, at 3.30.—The Total Eclipse: J. N. Lockyer.

MONDAY, MARCH 20.

ANTHROPOLOGICAL INSTITUTE, at 8.—Adjourned Discussion on the Racial Aspects of the Franco-Prussian War.—On the Migrations of the Georgians, Circassians, and Amazons, and their connection with the Tibeto-Caucasian Race: Mr. Hyde Clarke.

ENTOMOLOGICAL SOCIETY, at 8.—On Additions to the Atlantic Coleoptera: Mr. Wollaston.

VICTORIA INSTITUTE, at 8.—On some Curiosities of Ethnology:—Rev. J. H. Titcomb.

LONDON INSTITUTION, at 4.—On Astronomy: R. A. Proctor, F.R.A.S. (Educational Course.)

ROYAL COLLEGE OF SURGEONS, at 4.—On the Teeth of Mammalia: Prof. Flower.

TUESDAY, MARCH 21.

ZOOLOGICAL SOCIETY, at 9.—Report on additions to the Society's Menagerie during the month of February 1871: P. L. Sclater.—On the Birds of Santa Lucia, West Indies: P. L. Sclater.

STATISTICAL SOCIETY, at 7.45.—On Statistical Returns required by Parliament: Mr. Purdy.

ROYAL INSTITUTION, at 3.—Nutrition of Animals: Dr. Foster.

WEDNESDAY, MARCH 22.

GEOLOGICAL SOCIETY, at 8.—On the Passage beds in the neighbourhood of Woolhope, Herefordshire, and on the Discovery of a new species of *Eurypterus*, and some new land-plants in them: Rev. P. B. Brodie, M.A., F.G.S.—On the Cliff-sections of the Tertiary beds west of Dieppe, in Normandy, and at Newhaven, in Sussex: W. Whitaker, B.A., F.G.S.—On New Tree-ferns and other Fossils from the Devonian: Prof. J. W. Dawson, F.R.S.

SOCIETY OF ARTS, at 8.—On Drill, the Complement of the Present School Teaching: Major-General Eardley-Wilmot, R.A.

ROYAL COLLEGE OF SURGEONS, at 4.—On the Teeth of Mammalia: Prof. Flower.

THURSDAY, MARCH 23.

ROYAL INSTITUTION, at 3.—Davy's Discoveries: Dr. Odling.

ROYAL SOCIETY, at 8.30.

SOCIETY OF ANTIQUARIES, at 8.30.

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ERRATA.—Page 370, first column, line 10 from bottom, for "show us traces" read "show no traces"; second column, line 15, for "limit" read "limb."